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The Teaching of Agriculture in the Public Schools

By

A. CASWELL ELLIS
Associate Professor of Education

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BULLETIN

ON

THE TEACHING OF AGRICULTURE

IN THE

PUBLIC SCHOOLS.

CONTENTS.

INTRODUCTION.

Two years ago the writer, with the aid of Miss Julia Estill, then a student in the University Department of Education and a Fellow in Botany, began the preparation of a Bulletin on the Teaching of Agriculture. On account of Miss Estill's leaving the University to enter the public schools as a teacher, this work was not completed, though much valuable material was collected and Miss Estill had prepared an outline of the course in Nature Study for all the elementary grades leading up to the special work in agriculture. This important outline we hope will later be perfected and published. In the meantime, it seems unwise to wait longer before giving to the public such facts as we have gathered concerning the methods of teaching agriculture. The movement for the introduction of agriculture into the public schools of Texas has grown so strong that some definite action must soon be taken. This movement is of such importance to the State and the consequences of the initial action are so far-reaching that every effort should be made to start aright. Numerous States and countries have introduced agricultural education before us. Many have made serious errors and costly blunders. We, too, by an ill-advised plan and undue haste, may make a blunder which will not only injure the existing educational system, but bring the teaching of agriculture into such disrepute that it will take years for it to recover its good name. Before any plan is proposed there should be a clear understanding as to what agricultural education is, what has been accomplished and what not accomplished in other countries, and what our present local educational conditions are. Shall we require a course in agriculture in all our rural schools? That depends upon whether it can as a fact be taught there without seriously crippling the work now done in these schools. This question can be answered intelligently only when we know definitely what a course in elementary agriculture contains, what equipment it demands, what special training is needed upon the part of the teacher, and how much of the teacher's time it will consume. Then we must know how much of the average Texas teacher's time is now free, or might be left free, for agriculture, and how much preparation the rural teachers have for teaching agriculture. If they have none, then we must find whether it is possible for them to learn it, and where it may be taught them. Shall all teachers be required to pass an examination on agriculture, even though they be not required to teach it? Here again one needs to know just what elementary agriculture involves and what means are at hand by which the teachers may prepare for this examination. If the schools and courses of study in agriculture are not at hand, then what, if any, provision for this need can the State economically make? Shall the State introduce the teaching of secondary or high school agriculture? If so, shall this secondary agriculture be taught in the regular high schools along with other studies or shall separate agricultural high schools be established?

Here again one can give no intelligent answer until one knows definitely what courses in secondary agriculture involve, the laboratory equipment needed, and the training demanded of the teacher. Then one needs to know the actual equipment of our high schools and high school teachers, and the possibilities for training such teachers as are needed for this work.

All of the facts which are needed to answer intelligently these and other questions involved in the introduction of agriculture into our public schools are easily obtainable. To blunder ahead without first studying carefully these facts and providing a rational plan, based upon the results of the experience of others and upon a knowledge of the facts involved, would be an educational and political crime. This Bulletin attempts to give briefly these facts.

While we do not propose to offer here a complete plan for the introduction of agriculture into the public schools, we feel that the facts which are presented make clear at least the following points:

1. That elementary agriculture properly taught is a valuable study and well worthy of introduction into the schools, because of the useful knowledge which it offers and the mental training which the method of its study gives.

2. That no special teachers are necessary for the teaching of elementary agriculture and that the present active teachers may be prepared for this work in short two months' summer or winter courses, and future teachers may well learn it as a part of their normal school training.

3. That only the very exceptional teacher in the one-teacher rural school of Texas would have time to teach a course in agriculture worthy of the name, but that in the 2000 schools with two or more teachers the teaching of elementary agriculture is perfectly feasible as soon as provision is made for training teachers in this line.

4. That the necessary physical equipment for elementary agriculture may be easily provided locally and at a very few dollars' expense.

5. That Texas can at small expense have ample means provided in existing institutions for the education of all needed teachers of agriculture.

6. That secondary agriculture requires a laboratory and laboratory equipment and a special teacher specially trained.

7. That these may far more economically be added to a regular high school than provided in a separate agricultural high school, and that secondary agriculture so taught is more apt to reach the masses of the people than when taught in separate schools.

8. That the introduction of secondary agriculture into our present high schools, and into such county high schools as may yet be established, will cost less than the introduction of manual training, that it is entirely feasible, and should be done.

I wish to express my indebtedness to all who have given me aid in the preparation of this Bulletin, especially to Miss Estill, who helped to collect this data, and to the United States Department of Agriculture for permission to reprint so many things from the excellent Bulletins issued by that Department.

A. CASWELL ELLIS.

HOW AGRICULTURE IS TAUGHT, AND HOW IT MAY BEST BE INTRODUCED INTO THE SCHOOLS OF TEXAS.

THE CONTENTS AND VALUE OF SCHOOL COURSES IN AGRICULTURE.

There are three points about agricultural education which are now of special interest to Texas educators and to citizens who wish to work for the good of their State.

First. What is agricultural education? Just how is agriculture taught in the schools?

Second. Is this teaching of any real value, either through the information given or through the powers of mind and body trained?

Third. What is possible just now in the way of introducing this teaching of agriculture into the rural schools of Texas What sort of courses could be introduced? How much would the necessary material equipment cost? Would special teachers be necessary? If so, how many would be needed, where could they be procured, and how could they be paid? If the regular teachers could teach the agriculture, then where could these teachers themselves first learn agriculture and learn how to teach it, and how far would the teaching of agriculture by the regular teachers interfere with the work they are now trying to do?

Other States and countries have now had a long enough experience with the teaching of agriculture to enable us to answer definitely the questions as to what agricultural education is, and what definite value it has. This same experience of other lands and other States, together with well-known facts about the educational system of Texas, will enable us to reach fairly certain conclusions as to the third group of questions; i. e., What can be done now in Texas, and how can we do it?

Taking these questions in order, we will say that the school study of agriculture the world over is fundamentally the same, as plants grow and chemical elements compound and disintegrate according to the same laws whether in Texas or Nova Scotia. Each locality has, to be sure, its own range of variation of plant and animal life and its own climatic possibilities, which would need to be taught also. The courses offered in an elementary school usually cover five phases of the subject, as follows: plant production, animal production, dairying, rural engineering, and rural economics.

Plant production is studied first in general, the structure of plants and their physiology, the processes by which they feed from air and water and earth, how they reproduce themselves by seeds, bulbs, cuttings, grafts, buds, how they are fertilized and cross-bred, and how new variations and modifications are produced.* After this study of the internal

*As a concrete example of one phase of the work we might consider plant breeding as carried on in Illinois. Under the inspiration of the professor of agriculture in the University of Illinois, the farmers and school boys have been breeding thoroughbred corn. They have bred with the view of getting a variety giving larger yield, and also a variety possessing a special chemical quality, which gives it an increased price in the market. This process is very simple and the school

elements, comes the study of the external elements affecting plant growth: first, the effect of light, heat, moisture, air and the various combinations of these called climate; second, the soil, how soils originate, the nature and function of the soil in general, the properties of the soil, and main classes of soil, such as sand, clay, loam, peat, silt, and the peculiar properties and adaptabilities of each, the effect of natural temperature, moisture and aeration; third, a study of the management of the soil, drainage, tillage, irrigation, the causes of impoverishment, the chemistry of manuring and fertilizing, and the scientific basis for proper rotation of crops. This is followed by a study of the general classes of farm crops; cereals, grasses, legumes, tubers, etc., after which the definite individual crops of the particular section are studied. Here there is actual cultivation of a field, through which are studied the preparation of the soil, the selection of the seed, the testing of the seed,* the planting, the methods of cultivating during different stages of growth, the protection from weeds, disease, insects, birds, the harvesting and

children have shown themselves able to vie with their parents and sometimes to take the prizes at the fairs. Superintendent Kern of Winnebago county reported in 1904 as follows: "On the Funk farm, the 1902 breeding block record for ear No. 99, planted in a single row, showed a rate of yield of eighty bushels per acre of seventy-pound corn, while the multiplying record for 1903, planted in five-acre plots, shows that plot No. 10, planted from the progeny of ear No. 99, yielded at the rate of ninety-nine and one-half bushels per acre of same weight corn. The boy of the Winnebago County Farmer Boys' Experiment Club who won first prize in the corn contest of 1903, had a plot of corn which yielded at the rate of 125 bushels per acre, while several others had plots that approached the 100-bushel mark."

Superintendent Bollan of Mason County gives a somewhat similar report, adding as follows: "Best of all, the boys and girls have been enabled to discover for themselves the value of wisely directed effort in the selection of seed and in the care and cultivation of their crops. They have seen, also, something of the reward of such effort, for some of them have been able to sell their corn readily for $1.50 per bushel, while that of their paretns' brings 40 cents."

In a somewhat similar way, the yield from the oat crop in certain localities in Minnesota has been increased 25 per cent by the improved seed developed by farmers and school children through the intelligent working of this simple process of selection and isolation. These examples show how much it would mean for Texas, if all our farmers and children were educated up to breed and improve our cotton and other seeds crops.

*A brilliant demonstration of the value of learning how to test the vitality of seed corn before planting it was made in Iowa. By teaching the people of Iowa the simple process of testing seed corn before planting it, her A. and M. college has increased the value of the corn crop of Iowa several millions of dollars per year. The process of testing is simply this: Take a box about two feet square and four inches deep, and fill it half full of wet sand. Then label and number each ear of your seed corn, pick out four grains from each end and four from the middle of each ear and lay these grains in a row in your wet sand box, and number this row on the edge of the box to correspond with the number on the ear of corn. When all ears have thus been sampled and the grains laid out in rows and numbered, then lay a piece of cheesecloth down on top of the grains of corn and fill in a couple of inches of sand on top and keep the sand moist for a few days. Then by lifting up the cheesecloth you lift off all the sand on top of the grains and expose the sprouting seed to view, and can see which ears have given strong vital sprouts, and which have not. By selecting the vigorous ears and planting these only, you will secure a better stand, more vigorous plants, and a bigger yield. Surely things like this are not too complicated to be taught to average Texas boys by average Texas teachers.

marketing. Another very important phase of plant study is the study of trees, with a view of protecting and developing our forests, our orchards, and our nut groves.

In *animal production* they study horses, cattle, sheep, swine, poultry and bees. Attention is called to the different breeds of each of these and the main characteristics of each. The pupils are taught how to judge animals. They are taught their care and management, their feeding for different purposes, water supply, exercise, housing, preparation for market, and the marketing.

Under *dairying,* the qualities of the different breeds of dairy cows are explained, and their feeding and management studied. Then milk is studied, its composition, causes of souring and tainting, proper cleanliness of stables, cows, attendants, and vessels, the straining, aerating, and cooling of the milk, its marketing for direct use or for condensing or cheese-making, also the creaming and churning of milk, the different kinds of churns, the effect of temperature on churning, the salting, coloring, working, packing and marketing the butter.*

Under *rural engineering* is taught: first, the planning and laying out of farms, the locating of fields, fences, roads, drains, and houses; second, proper and economic construction of houses, barns, silos, fences, etc., and the construction of drainage, irrigation and road-ways; and third, the simpler varieties of farm machinery together with the proper use of each and the method of caring for it.

Under *rural economics* are taught the methods of keeping farm accounts, keeping feeding and milk records, breeding records, etc., and the matters concerned with marketing and transportation in general.

So much for the work in the elementary school. In the high school, these same general topics are studied again, but in a more advanced way through scientific courses in such subjects as agricultural chemistry, physics and botany. In the agricultural college, these same topics will again be taken up, going still deeper into the mundamental chemical, physical, and biological laws lying at the bottom of all agricultural processes.

It will be seen by this that there is a very definite and useful body of knowledge about some of the important phases of agriculture. Now we are asked, can this be taught in the schools, and should it be taught? That it can be taught is demonstrated by the fact that it is taught in the successful schools already established in Germany, France, Austria, Italy, Belgium, Canada, Japan, and many other countries, and in sev-

*The practical value of scientific study of cattle breeding and of the processes connected with handling milk and its products has been clearly shown in Wisconsin. Through the new process of curing cheeses, discovered at the University of Wisconsin, that State now saves each summer more than a hundred thousand dollars worth of cheeses which previously spoiled every year under the old rule-of-thumb methods of curing cheese brought over from Europe. For years the rest of the country has poured millions into the coffers of Wisconsin and the Middle West for her butter and cheese and high grade milk cows, because of her separator, her Babcock milk tester, and her scientific knowledge of the processes connected with milk and its products. Texas country butter sells in Dallas today at 13 to 17 cents per pound; creamery butter at 25½ to 27½ cents. Knowledge of the processes of handling milk and butter makes this difference. Ignorance of this then alone loses for Texas about 10 cents per pound on her annual crop of millions of pounds of butter.

eral States in our own country. Whether it ought to be taught in the schools, is a question about which exceedingly able men differ in opinion. If it is to be introduced into our schools, we ought to consider exactly what it will cost in time of teacher, time of pupils, and in physical equipment, because some of this time and money will come out of the time and money which might be devoted to the general educational studies now in the schools. There are some who seem to think that a teacher can work late in the night preparing lessons and correcting papers, can then hear thirty or more recitations a day, hold the children in the school for five or six hours, and after school go out in the sunlight and fresh air and get health and strength and happiness in reading one of these interesting text-books on agriculture with the pupils and tickling the earth with experimental agriculture. The slightest consideration of what real teaching of agriculture means shows the absurdity of this notion. Teaching agriculture even to elementary pupils means that the teacher must study carefully the various kinds of soils of the locality, must collect and arrange in vessels samples for study in the school-room, must carry the pupils to the various soils where they lie, must make receptacles, prepare beds, and arrange experiments in plant growing, root-pruning, fertilizing, in the artificial change of air, moisture and light conditions, in plant breeding, in seed testing, etc., etc. He must find who in the neighborhood has samples of the different kinds of animals which the class needs to study, must arrange plans to have these animals at the school at the proper time, or to take the pupils to them in order to demonstrate properly the facts studied in animal culture. Feeding experiments must be definitely arranged, and material therefor provided and weighed, proper records of all work must be kept by teacher and pupils, and the teacher must correct all this written work of the pupils if the work is really to be worth while. And so on would it go with hundreds of details of this work. If agriculture is taught in such a manner as to be of any serious value it will cost something, and it will take some of the time of the teacher which might be given to the other studies. Admitting all this, it still seems to me that it ought to be introduced into our schools for the very good reason that it has more worth, both in the knowledge given and in the mental powers trained by its study, than many of the things now studied. At least a fourth of what is now taught in arithmetic, fully half of that taught in geography and much else in our school text-books is almost useless, as taught at present, and what little there is of value in these parts could be gotten incidentally in the study of agriculture if properly taught. The study of agriculture would help the work done in arithmetic and geography, and would greatly improve the reading, writing, and English work, for here the pupils would in their study, and in their records and reports, be practicing reading and writing in a natural and interesting way under pressure of the necessity of observing and reading in order to learn something which they want to know, and of writing in order to record their experiences, instead of writing empty formal compositions when they have nothing in their heads to write. Agriculture memorized out of a book is no better nor worse mental discipline than any other study memorized out of a book. But if it is studied by a correct pedagogical

method it will give practice in close observation and accurate description, in orderly arrangement of facts, and the drawing of rational conclusions from them. These are the same powers trained in all other sciences. As the principles involved in agriculture are very general principles, and the methods used in its study are methods of wide application to other fields of life, it is not a narrow, but a liberal, study. There are, of course, many mere detailed facts to be learned, having no general application in life. In so far, the study is not liberal, but narrowing. This is true, however, to some degree, of every subject in the curriculum. Whether a study is liberal or not is largely a matter of what phases of the subject are taught and how these are taught. What general principles or liberalizing views of life does a child get out of learning which States bound Idaho on the north, or what is the principal seaport of Madagascar, and a thousand other such things taught in each of our school subjects? Pedagogically taught, agricultural studies give just as good and just as liberalizing training as do any of the natural science studies in our curriculum, and, in my opinion, it gives a body of knowledge of far more value than much of the matter now in those courses. It offers really a natural and interesting compound of the best things in all the sciences, and furnishes the best possible introduction to any future study of a specialized form of science. To say that it does not give a knowledge of, and an insight into, the workings of the human mind and the human heart, as does literary study, is simply to say that it is a science. Of course, it does not give this, neither does arithmetic, geography, physical geography, physics, or any science. In its humanizing effect, literary study must ever stand pre-eminent. Agricultural education should never be introduced in such a way as to injure this side of our school work, which is still far too weak. But in my opinion it can without harm, and should, supplant much of the scientific and pseudo-scientific matter now offered children. Much more might be said about the value of agricultural education in leading people to an interest in nature, to a love for country life, and, through healthy outdoor exercise and first-hand touching of actual facts, to a mental sanity and solidness which our too exclusively bookish education is really liable to injure. All further discussion, however, must be given up now to take up the immediately practical problem: What can we do now in Texas?

WHAT CAN BE DONE NOW IN TEXAS?

In the first place we have the physical equipment for agriculture on hand. There is hardly a community in the State that can not provide by donation the few acres of land needed. The government will furnish the seed, the neighbors can lend from time to time the necessary animals for temporary use and study. The few tools and supplies in the way of bottles, pots, chemicals, etc., need not cost $10 per school, and could be obtained by local subscription or a school entertainment. There are several fairly good text-books now on elementary agriculture and more are constantly being written. The professor of agriculture at our A. and M. College, or some other well-trained man in this line, could soon prepare such supplemental text as our local conditions demand. There

are plenty of children eager to learn. Nothing stands in our way but the ignorance of our teachers of the science of agriculture, and of how to teach it, and the presence of so many one-teacher rural schools. When only one teacher is in a school, he or she now has on the average already thirty or more classes per day. Nor will the suggested eliminations of subject matter remedy this. These two serious difficulties then are here, and we would be blind to the welfare of this movement and of the State if we ignored or minimized them. Teachers can't teach agriculture unless they first know something about agriculture, and teachers can't hear thirty or more classes a day in a dozen academic branches and then teach agriculture, too, without wearing themselves out. It is true, that fresh air and sunshine and a lively subject will stimulate one when dead-tired of the school-room, chalk dust, bad air and dry lessons. But, say what we will, teaching agriculture involves a deal of work that is not a fresh-air picnic, and will make many demands on the vitality and mental energy of the teacher. I believe that it would be a mistake and would do positive harm to require at this time that agriculture be taught in all the one-teacher rural schools of Texas. Perhaps some few exceptionally capable teachers, located under unusually favorable conditions, even though alone, might, if they knew any agriculture, teach it successfully without seriously crippling their present work. These are rare exceptions. Out of the 8000 one-teacher rural schools in Texas there are, in my opinion, more than 7000 in which it would be folly to require agriculture at the present time.

What we can and, in my opinion, should work for now is: first, a requirement that all teachers shall learn something about scientific agriculture* and how it is taught, and that the capable and fortunately located ones be *encouraged* to introduce agriculture into their schools; second, that the teaching of agriculture be *required* in rural schools possessing more than one teacher as soon as teachers for this work can be trained. There are nearly 2000 of these rural schools in Texas having two or more teachers in them. In the third place, let the State encourage the independent districts to introduce agricultural education in the same way that she has encouraged them to introduce manual training. There are nearly 1000 of these large and fairly well equipped independent schools in Texas. Let us start by *requiring* agricultural education in the 2000 rural schools with two or more teachers, and by *encouraging it in a definite way* in the 1000 independent schools, and in the very exceptional one-teacher rural schools. Here is a task sufficiently large. Get agricul-

*By this I do not mean that every teacher should at once be required to qualify himself for teaching agriculture and be given a rigid examination even on the elements of scientific agriculture. This is neither necessary, desirable, nor possible. The general body of the teachers need only a very limited knowledge of the most general and fundamental facts and principles of agriculture, of the way in which the subject relates itself to the other school work, of the methods by which it may be taught, and of what books and others sources of information may best be consulted for further information. All this could be learned from a single well arranged bulletin of a hundred pages, which the State Department of Education could have prepared, and which our average teacher should fairly master in a few days. This is intended to arouse an intelligent general interest among the teachers in this subject, rather than to prepare them to teach agriculture.

ture first into the 3000 schools in which it is now a possibility, and in the meantime educate teachers and educate public sentiment with a view to still wider introduction. The sudden regardless introduction of agricultural education by law into rural schools has been tried in France, in Canada, in Ireland, and has failed every time, and all have been obliged to rub out and start over again on a new plan. Let us profit by their experience and start with a clean-cut, workable plan. The difficulty of even the one-teacher school is not an insuperable one. By lending our aid to the campaign now progressing so triumphantly for the consolidation of these little one-teacher rural schools we can soon have 3000 more consolidated schools ready for agricultural instruction. The consolidation of the one-teacher schools and the employment of a well-trained and well-paid school superintendent in each county are both prerequisite to the satisfactory and complete carrying out of agricultural training in the rural schools.

There remains one question more to settle. How shall we obtain teachers, or provide means of training our present teachers in agriculture? For the teachers of agriculture in our high schools and for the directors and general leaders of this work, we must look to our A. and M. College. The University has not the equipment for training these leaders, nor is the work of our normals of high enough grade to do this. To furnish such teachers and leaders in agricultural education for the State will be, in my opinion, one of the greatest benefits the College can confer upon the State, and for this purpose the Legislature should by all means give extra and ample support. Whatever additional instructors in agriculture are needed should, of course, be provided, and, in my opinion, there should be provided also a professor of pedagogy, for the future teacher of agriculture ought to learn not only agriculture, but also the principles of teaching. He should have a solid grounding in the history and principles of education in general in order that he may grasp the work of education in a broad and intelligent spirit, and he should know something of psychology and something of correct methods of teaching, in order that his own teaching may be economic and rational. It might be urged against providing special training of teachers at the A. and M. College that the State University and the three normals are already giving pedagogical instruction, and that the A. and M. students could go after graduation to these institutions. There are over 16,000 teachers and school officers already in Texas, and over 3000 fresh ones are needed each year to supply the places of those falling out and to fill newly-created positions. All of the institutions in Texas for the special training of teachers, running at their full capacity, can not supply more than about one-fifth of this demand. We need all the help we can get in training teachers.*

*There are those who wish the Legislature to grant to the graduates of the A. and M. College, and the College of Industrial Arts, a State certificate to teach in public schools the agricultural and industrial branches only. If a certificate is granted these graduates, it should not be restricted to the agricultural and industrial subjects. In the first place, this would be unjust, for the work done in the strictly academic lines at the A. and M. and the College of Industrial Arts is fully abreast that of the Normals which grant life certificates. In the second place, it would be very inconvenient, for many schools can not have a separate teacher for agricultural and industrial branches alone,

For the training of our present teachers in elementary agriculture there should be established at once short winter and short summer courses especially arranged for teachers. The experience with these short two months' courses in Belgium and elsewhere has shown that an average teacher, with a turn in this direction, can in one such session of two months get a fair knowledge of what is taught in elementary agriculture, and of how to teach it. In two such short sessions, with a year of reading and of practice in the school in between, he may become a really good teacher of the *elements of agriculture,* such work as is possible in the elementary rural schools. These summer courses for teaching elementary agriculture should be provided at our A. and M. College, our three normal schools, and College of Industrial Arts. Such work should also be introduced as one of the studies in the regular course of the normals. If all of these suggestions are carried out, it will be possible within a year to have something like a thousand teachers get the preliminary training needed to teach elementary agriculture. If the demand be great enough, and it be possible to obtain funds enough for this without crippling the other work of the University Summer School, there could be offered at this school also a short course in elementary agriculture for teachers. For such work little equipment is needed, and any necessary special instructors could be imported till such time as the pressing needs of the State could be met without this.

To sum up, then, we would say finally: We have about 2000 rural schools and a thousand city and village schools, in most of which work in elementary agriculture can be profitably introduced as soon as we can get teachers. We can have, at slight expense, in the short two months' summer courses in the A. and M. College, the three normals, the College of Industrial Arts, and, if necessary, the University, together with the regular work of the A. and M. College, the normals, and the College of Industrial Arts, ample means for training rapidly our regular teachers for this work. If we will first accomplish this, we build on certain ground and prepare the way for the rapid and successful introduction of the teaching of agriculture into all of our schools.

SHALL THE STATE PROVIDE SEPARATE AGRICULTURAL HIGH SCHOOLS?

The instruction in elementary agriculture is, we have seen, quite simple, demands little physical equipment, and no long and expensive prep-

but will be obliged to have the teacher of these subjects teach a few academic classes also. These two colleges then should be allowed to grant full certificates, or none at all. The Regents of the University will not grant any certificate to teach, even to her graduate, unless he has studied not only the subject matter which he wishes to teach, but also the strictly professional aspects of the work of teaching, managing, and organizing schools. In other words, the University requires of all who obtain teachers' certificates the completion of certain courses in the science and art of education. The Normal schools do the same. The A. and M. College and the College of Industrial Arts as yet have no courses in pedagogy, no professional training in teaching. It would, therefore, in my opinion, be unwise and a decided blow to the professional training of teachers in this State to grant their graduates certificates to teach agricultural and industrial, or any other, branches until these institutions add courses in pedagogy to their curriculum, and require these of all students preparing to teach. If this is done, I see no reason why their graduates should not be granted certificates to teach both the agricultural and industrial and the academic branches.

aration on the part of the teacher, and hence can be taught by regular teachers in the regular elementary schools. The instruction in secondary agriculture, high school agriculture, embracing preliminary courses in agricultural chemistry, agricultural physics, zoology, etc., demands laboratory facilities and a special teacher highly trained in the fundamental sciences underlying agriculture—a training which can be gotten only by several years of study in a well-equipped agricultural college or other institution offering similar work. Because of the need of such laboratory facilities and such specially trained teacher for secondary agriculture, it has been commonly the opinion that it demands a set of special agricultural high schools, specially equipped and specially manned.* Wisconsin has two such agricultural high schools, Minnesota one, others are projected in other States, and they have long been in operation in Germany, Japan, and several other foreign countries. That farmers should be educated in special schools, specially equipped, separate and apart from other classes of society in European and Asiatic countries which hold to monarchies, to rigid class distinctions, and limited suffrage is but natural and thoroughly consistent with the political organization and social ideals of these peoples. But that such schools should be set up in democratic America, is indeed strange and inconsistent with our traditions and our ideals. It is but another case of the blind copying of German educational practices, and indicates the danger of superficial study of foreign school systems. It seems to indicate also that some of our educational leaders do not yet recognize the real spirit of our own institutions, nor understand that any single foreign institution is but a member of a vast, closely-related, and mutually dependent set of institutions, the reasons for the establishment of which can be understood only through a knowledge of the history and ideals of this people. The success of an institution is, to be sure, dependent in part on its internal character, but also in large measure upon its fitting into the established social system and meeting the ideals of this people. Germany, with her inherited rigid class distinctions and with her limited suffrage, naturally educates her farmers in her agricultural schools, her artisan and trades-folk in her *gemeinde-schule* and trades schools, and her professional classes in her *gymnasium,* while young princes are taught by private tutors. No better plan could be devised to keep the various classes in the community ignorant of one another, to narrow each one's life down to the limited interests of his own set, and to preserve thus the hereditary class distinctions so dear to the average German. At present we have no rigid class distinctions in America, certainly none in the West. If we have become persuaded that this is a mistake and wish to establish them, then let us establish these separate systems of schools for the different classes of occupations and bring each class up ignorant of and out of touch and sympathy with the others. But if we are to preserve our universal suffrage, by which every one has equal vote in determining measures relating to any and all classes, is it

*At present our Agricultural College is forced to teach this secondary and even some elementary agriculture to all of her students before she can commence with the true collegiate work in agriculture. As there are no preparatory schools in the State which teach agriculture, our College must either prepare her own students, or have no students.

not imperative that each class have an intelligent appreciation of the services and needs of all other classes? It has been the pride of our American schools that the children of Frenchmen, Germans, Americans, of carpenters, cooks, merchants, doctors, poets, politicians, all were turned into our common school together and came out prepared for their different occupations, but with common American ideals, with a common democratic spirit of tolerance and appreciation. This appreciation of the worthiness of the work done by each class in society, this intimate knowledge of the needs and aspirations of all classes, which gives a certain all-roundness, and adaptability, to the American and makes possible the success of our democratic government, is gotten undoubtedly in large measure from the free commingling of the children of all classes in our common public schools. A very large part, perhaps the largest part, of the education gotten by a child in his school life comes from the association with his school companions and with his teachers out of class. In order to be efficient we are obliged to narrow the class work and to restrict the studies of a boy preparing to be a farmer largely to subjects which bear upon this work. This is narrowing enough without putting him off in a school in which all the pupils and all the teachers are studying exactly the same subject. By this, not only will the farmer lad lose the stimulation and the broadening knowledge of life and society which he would gain by being taught in the same school with the children from other classes of society and with varied interests, but the children from these other classes will lose on their part the stimulus offered by the presence of the farmer boys. Each will be weakened and narrowed, and society will tend to fall apart form sheer lack of any common interests, common knowledge or mutual appreciation. The establishment of separate classes ignorant of, and hostile to, each other will be an accomplished fact. That there are unquestionable losses and grave danger to democratic government in this separation of the different classes of society into different schools, no thoughtful man can deny.

These separate agricultural high schools are advocated by many educators primarily because they seem to simplify the problem of introducing the teaching of secondary agriculture. At first blush it seems simpler to copy with slight modifications the European agricultural high school and graft it on to our school system. A more careful study will, I believe, show that it would be more economical as well as far sounder to develop a system of agricultural education within our own common school system in harmony with our own social organization and social ideals. Nothing could be simpler. Merely introduce courses in agriculture into our present well-established high schools and into such new ones as are later established. We had the same problem when we wished to introduce manual and industrial education. When Texas decided that she ought to provide instruction in manual and industrial arts she merely added to her regular high schools the workshops and instructors in these lines. In this way we have in three years, at a cost to the State of a few thousand dollars, obtained twenty high schools in which manual and industrial arts may be studied. To have set up an equal number of equally good separate manual training schools would have cost the State hundreds of thousands of dollars, and would have separated all children

pursuing those courses from the broadening association with comrades and teachers pursuing varied lines of work. Thus in three years at a cost of a few thousand dollars we have introduced twenty manual and industrial high schools. Wisconsin on the German plan spent fifty thousand dollars building and equipping her two separate agricultural high schools; the two cost twelve thousand dollars a year running expenses, offer a narrow two-year course, have only three teachers and about sixty-five pupils each, and have in four years led to the introduction of but one new similar school in that State. Secondary agriculture is really easier to introduce into our regular schools than was manual training, for the equipment costs less. To place the courses in secondary agriculture in our regular high schools is then not only in harmony with our social ideals and the spirit of our American institutions, but it is actually far cheaper and is more easily and more quickly done. There is the inevitable expense of an expert teacher, and of some laboratory equipment, but this would have to be provided in the separate agricultural high school just the same, and in addition teachers and equipment for many of the academic courses already offered in our regular high school. In the best of these special agricultural high schools, as recommended by Professor Hayes, and the best authorities on agricultural education, only one-third to one-half of the work done is work strictly in agriculture, while the rest is in the ordinary academic branches which are necessary for success in any line. Instead of establishing a new separate school when half of its work would be a repetition of work already done in the regular school, the economic and rational plan would be for the State or the community to add to the regular established high school the extra teacher and extra laboratories needed for the courses in secondary agriculture and allow this work in agricultural lines to be elected in the place of certain other courses, by all students desiring preparation for farming or for advanced work in our A. and M. College. In this way will money be saved, our school system simplified, and society unified. Where no centrally located village, or rural, high school is already in existence, and it becomes necessary to build and equip a new one, even in the country, this school should by all means not be restricted to the teaching of agriculture. All of the children of country people ought not to, and will not, become farmers any more than all the town children ought not to, and will not, remain in the town. The country child has a right to a chance at preparing for a profession or a trade, if his talent lies in this direction, just as the town child has a right to learn about agriculture if his talent and interest lie in the direction of farming, and both children have a right to that preparation for intelligent democratic citizenship which comes from the broadening of their sympathies and widening of their general mental outlook through the companionship during their school days of pupils and teachers with varied interests and from various classes of society.

AGRICULTURAL HIGH SCHOOLS OF WISCONSIN.

In 1901 the Legislature of Wisconsin authorized the establishment of two Agricultural High Schools, one-half of the maintenance of which was assumed by the State, provided that neither school should receive more than $2500 per year from the State. In 1903 the State assumed two-thirds of the running expenses of these schools and raised the limit to $4000 per school.[1] The school at Wausau, Marathon county, was opened October 6, 1902, and the one at Menomonie, Dunn county, during the same year. The buildings, building-site, and equipment of each school cost approximately $25,000 each. The site, buildings, and equipment were paid for out of local funds, a part in each case being donated. The two schools have three teachers each, as follows: A principal who teaches agriculture, a teacher of manual training, and a teacher of domestic economy. Each school costs about $6000 per year for maintenance, of which the State pays $4000 and the county $2000. The course of study is practically the same in these two schools, covering two years of eight months each. Each school offers also a short winter course of twelve weeks.

No entrance examination is required. In order to pursue the work of the regular course to best advantage, students should have a common school education. For the short winter course not even this is requisite. The short winter course is for older or busier people who can spare only a few winter months. The regular course is for boys and girls who have completed, or nearly completed, the rural school course. The course of study in the Dunn county school is as follows:

DUNN COUNTY SCHOOL OF AGRICULTURE.

REGULAR COURSE OF STUDY.[2]

YOUNG MEN.

First Year.

First Term: Work with soil, *5; Carpentry, †5; English and library reading, 5; Business arithmetic, 5.

[1]The following outline of this law as amended in 1903 is taken from the Dunn County School of Agriculture Bulletin, March, 1905:

Sections 1, 2 and 3 create the schools of this class and provide for county school boards of three members.

Sec. 4 allows two or more counties to unite in one school.

Sec. 5 makes the county treasurer the school treasurer.

Sec. 6 names branches to be taught.

Sec. 7 requires a plot of three acres for farm practice.

Sec. 8 makes the school free to students in any county helping to support such school.

Sec. 9 makes the State Superintendent also superintendent of such schools.

Sec. 10 provides for list of four such schools when approved by the Dean of the College of Agriculture and the State Superintendent. Schools must be maintained eight months. The State shall pay county maintaining such school a sum equal to two-thirds the amount actually expended for maintaining such school during the year, provided that the total amount so apportioned shall not exceed $4000 to any one school in any one year.

[2]Reprinted with permission from the Dunn County School of Agriculture Bulletin, March, 1905.

*The numerals denote the number of recitation periods per week; †signifies double period.

Second Term: Soils and fertilizers, 5; Dairying, †2; Carpentry, †3; English and library reading, 5; Farm accounts, 5; Rural architecture, †2.

Third Term: Plant life, 5; Vegetable, flower and fruit gardening, 5; Poultry, 3; English and library reading, 5.

Second Year.

First Term: Plant life, 5; Blacksmithing, †5; Economic insects and diseases, 5; English and library reading, 5.

Second Term: Animal husbandry, 5; Blacksmithing, †5; United States history, 5; English and library reading, 5.

Third Term: Animal husbandry, 5; Vegetable, flower and fruit gardening, 5; English and library reading, 5; Civil government, 5.

YOUNG WOMEN.

First Year.

First Term: Cooking and sewing, †5; English and library reading, 5; Business arithmetic, 5.

Second Term: Cooking and sewing, †5; home economy, 5; English and library reading, 5; Laundry, 2.

Third Term: Cooking and sewing, †5; Plant life, 5; Poultry, 3; Hygiene, 5; English and library reading, 5.

Second Year.

First Term: Cooking and sewing, †5; English and library reading, 5; Economic insects and diseases, 5.

Second Term: Cooking and sewing, †5; Chemistry of foods, 5; United States History, 5; English and library reading, 5.

Third Term: Cooking and millinery, †5; Home nursing and emergencies, †2; Vegetable, flower and fruit gardening, 5; English and library reading, 5; Civil government, 5.

WINTER TERM, SHORT COURSE.[1]

FOR MEN.

First Winter.

Science of Agriculture. Dairying.
Farm accounts and commerce. Farm carpentry.
English.

[1]In addition to the regular work of teaching, each of these schools serves the purpose of a local experiment station and bureau of information for the county. The teachers and pupils do free of charge the following kinds of work for the farmers: Test milk, cream and skim milk, select cattle for purchase, test cows for milk fever, test seeds for germination and purity, treat oats for smut, treat legumes for bacteria, supply information about special crops, about methods of destroying harmful insects and weeds, give instruction in pruning fruit orchards and trimming shade trees, graft twigs brought by farmers on stock raised from seed and furnished free by the school, furnish new varieties of seeds, furnish cuttings of plants and flowers, lay out orchards, plan drainage systems, plan barns and farmhouses, furnish State and United States bulletins, and assist in the conduct of farmers' institutes.

FOR MEN.

Second Winter.

Feeding and care of stock.	Farm blacksmithing.
Soils and fertilizers.	Rural architecture.

English.

FOR WOMEN.

First Winter.

Home economy.	Sewing.
Cooking.	Laundering.

English.

FOR WOMEN.

Second Winter.

Cooking.	Millinery.
Sewing.	Personal and domestic hygiene.

English.

Summarizing the course of study of the Dunn county school we find that during the first year the boys* study: soils and fertilizers; vegetable, flower and fruit gardening; dairying; poultry, carpentry; rural architecture; business arithmetic and farm accounts; with one hour a day left to be divided between English and library reading on agricultural subjects. During the second year they study: plant life; vegetable, flower and fruit gardening; economic insects and diseases; animal husbandry; blacksmithing; with one hour a day divided between English and library reading on agricultural subjects for the entire year, and one hour a day each to United States history and civil government for twelve weeks. The Marathon county school has almost exactly the same curriculum. The work of these schools is plainly very narrow, being restricted to the immediately usable knowledge of farm affairs, with no studies of distinctly general cultural value aside from the twelve weeks' courses in United States history and civil government, and that part of the single English course which is not devoted to farm literature. The narrowing effect of this very one-sided curriculum is further augmented by the fact that all the teachers are interested solely in these agricultural and industrial subjects and all the pupils are pursuing this same course. As this point has been discussed elsewhere, we will not consider it further here.†

These Wisconsin schools seem to teach well the courses which they offer, but they do not seem to be solving very rapidly the problem of furnishing the State with a large supply of educated farmers. As these schools have been so much heralded, and as similar schools are now suggested for Texas, it might be well to give the statistics. The State has

*The comments made here on the course for boys holds with equal force in regard to the course for girls.

†See pages 15 to 16.

since 1903 offered to provide two-thirds of the maintenance ($1000 per year per school) of two or more similar schools, if any county or district would establish them. As yet but one has been established, and this is not yet open. The two original schools, then, remain the sole agricultural high schools in the State. They are absolutely free to students from their respective counties, and charge nominal fees to outsiders. They have been praised and advertised in many ways by the officials of the State and have received strong private support, moral and financial. Yet, the Marathon county school during its first year (1902-1903) enrolled only seventy-five pupils in the first year class, none in the second year class. Of these only five returned in 1903-4 for the second year work, and only one other outside student entered this second year work, making six in all. Only forty-seven entered the first year work in 1903-4, of whom only five returned in 1904-5 for the second year work. Five outsiders were admitted to this second year work, making ten in all. Forty-five entered the first year work in 1904, and only ten of these returned in 1905 for the second year, while four outsiders were admitted to this work, making fourteen in all. Of these only ten graduated in 1906. Of the sixty-one pupils enrolled in 1905-6, thirty-eight were girls. Of the seventy-five pupils in 1902-3, fifty-three were from the town of Wausau, in which the school is located, and of the sixty-one pupils enrolled in 1905-6, twenty-five were from Wausau.*

The record of the Dunn county school is similar. Complete data are not at hand, but in 1904-5 there were only eight regular two year graduates, thirty-six regular first year students, and twenty-nine short course, or irregular students. In 1905-6 there were fifteen regular graduates, and one short course graduate. Of these graduates nine were from Menomonie, the town in which the school is located. There were thirty-four first year regular students and fifteen irregular and short course students. Of these twenty-nine were from the town of Menomonie.

Thus the number of students enrolled in these schools has averaged about sixty-five, even including all the irregular students and the students in the short twelve weeks' courses. The number of students is smaller now than when the schools opened four years ago. From three-fourths to fourteen-fifteenths of the pupils drop out during, or at the close of, the first year. The Marathon county school has not averaged ten graduates a year during the three years in which it has had two full classes. All the data for the Dunn county school are not at hand, but the figures which we have show that the record must be practically the same. At this rate it would take an aeon to fill Wisconsin with educated farmer boys by means of such schools. The expense of building and equipment is practically three times as much per pupil as in the well-built city high schools in Texas. The cost of maintenance is about a hundred dollars per year per pupil enrolled, which is about three times as much as is the cost per pupil in the Dallas or Houston high schools, where teachers are liberally educated, and excellent courses are given in manual and domestic training, and good science laboratories are maintained. Wisconsin is putting $600 into those agricultural high schools

*The above figures are gathered from the Bulletin of the Marathon County School of Agriculture, August, 1906.

for every two-year graduate it gets back. Texas has 400,000 farms. It would take about four hundred such schools to put one such graduate a year on one farm out of every hundred in Texas. To put one such school in each congressional district would therefore be a most inefficient and most expensive plan. Thousands of Texas boys and girls need this training, and if our State is to keep her place in the march of progress they must have it. The only economical plan of providing this secondary agricultural education is to add teachers of agriculture to our regular urban and rural high schools, and to such county high schools as may yet be established. Then only one room need be added, instead of a whole building constructed, and one teacher employed, instead of a whole faculty. The manual and domestic work given in these special schools can be done with the regular equipment provided in ordinary high schools which teach these subjects. The agricultural chemistry, physics, and botany can likewise be taught in ordinary high school laboratories. The extra laboratory room, cheap out-house, few farm implements, and few acres of land needed in teaching the dairying, poultry, gardening, and farming could easily be provided locally. The cost of the special equipment needed by an average village high school* to enable it to teach agriculture would be less than has been the cost of providing for manual training, which we saw was so easily done.† If this plan is followed, then all the children in the community, who desire it, can have a chance at agricultural education, instead of restricting it to the few dozen who are willing to go into a narrow special school and cut themselves off from all general education for the sake of a few extra lessons in agriculture. A careful examination of the agriculture work done in these separate agricultural high schools will show that a considerable portion of it is elementary agriculture, and can be taught easily and at little expense by a regular teacher in all regular rural schools having more than one teacher, as soon as our teachers learn elementary agriculture in the State normal schools. What is left of strictly high school agriculture could be gotten by any intelligent boy in any regular high school equipped with a teacher of agriculture, an outhouse, and a few acres of land, and still leave over half of the boy's time to be devoted to general education and to the acquiring of a broad general experience and knowledge of humanity from associating with teachers and pupils of all classes of society and of varied interests.

*Both of the Wisconsin Agricultural schools are located in villages. The land used by the Dunn county school is rented and is located a mile from the school.

†See page 16.

THE MINNESOTA AGRICULTURAL HIGH SCHOOL.

The Agricultural High School established in Minnesota, which, together with the College of Agriculture is located in connection with and under the supervision of the State University, has proven to be perhaps the most successful Agricultural High School in America. Students upon completion of eight years' study in the rural or city schools may enter this school and pursue a three-year practical course, as outlined below. If they then wish to go into advanced work in the College of Agriculture, they must devote one extra year to study in general academic branches.

This school enrolled 718 students in 1905-6, and reports that 80 per cent of its students actually return to, and work on, the farm.

The following is the course of study:

FIRST [C] YEAR.[1]

FIRST TERM.

Agricultural botany (5)
*Drawing (2)
Music (2)
Farm Mathematics (5)

*Blacksmithing (2)
*Carpentry (2)
Military drill (2)
Agriculture (3)
Gymnasium (2)
*Practicums (2)

or

*Cooking (2)
Physical training (2)
*Sewing (3)
Social culture (1)
Field agriculture (3)

SECOND TERM.

Agricultural botany (5)
English (5)
Music or literary society work (2)
Comparative physiology (5)
Study of breeds (5)

*Carpentry (2)
*Drawing [farm buildings] (2)
*Blacksmithing (2)
Military drill (2)
Gymnasium (2)
*Practicums (2)

or

*Laundering (2)
*Drawing [farm houses] (2)
Physical training (2)

SECOND [B] YEAR.

FIRST TERM.

English (2)
Agricultural physics (5)
Dairy chemistry (2)
*Dairy husbandry ($2\frac{1}{2}$) { Dairy lectures / Dairy practice / Dairy breeds }
Fruit growing (3)
Music (2)
*Farm accounts ($2\frac{1}{2}$)

*Stock judging (1)
Breeding (2)
Military drill (2)
Gymnasium (1)

or

*Cooking (2)
Household art (1)
Physical training (2)
*Sewing (2)

[1]Taken from the Announcement of the University of Minnesota for 1905-6.

* Figures in parentheses indicate the number of periods per week in which the object is pursued. All work in subjects marked thus * extends through double time in the daily program.

SECOND TERM.

English (1)
Agricultural chemistry (5)
*Dairy husbandry (2½) { Dairy stock lectures / Dairy practice / Dairy feeding }
Music (2)
Agricultural physics (5)
Vegetable gardening (3)

Field crops (5) / Military drill (2) / Gymnasium (1) — or — *Cooking (2) / Home management (1) / Physical training / *Sewing (2)

THIRD [A] YEAR.

FIRST TERM.

Agricultural chemistry (7)
Forestry (3)
Entomology and zoology (5)
Poultry (3)
Algebra (5) Optional

Handling grain and machinery (1) / *Veterinary science (2½) / Gymnasium (1) / Music or military drill (2) — or — *Cooking (2) / *Sewing (2) / Music (2)

SECOND TERM.

Civics or geometry (4)
Plant propagation (3)
Algebra (5) Optional

Dressing and curing meats (1) / *Stock judging (1) / Feeding (3) / Soils and fertilizers (5) / *Veterinary science (2½) — or — Meats (1) / Home economy (1) / *Cooking (3) / Domestic chemistry (3) / Domestic hygiene (1) / *Sewing (3)

"The course of study in the School of Agriculture extends over three years, and the school year is six months long. This does not give sufficient time for preparation for college work, and it has been found necessary to supplement the course offered in the School of Agriculture by an additional year's work in general academic branches. The subjects offered in the intermediate year can be taken elsewhere in any accredited high school before entering the School of Agriculture. This intermediate year enables graduates of the School of Agriculture to enter the College of Agriculture on the same basis of preparation as students enter other departments of the University. English and mathematics are given prominence in the intermediate year.

"The following prescribed course, or its equivalent, taken in some other school, is required of graduates of the School of Agriculture, who desire to gain admission to the College of Agriculture:

FIRST TERM.	SECOND TERM.
Elementary Algebra (5)	Elementary Algebra (5)
Plane Geometry (5)	Plane Geometry (5)
English (5)	English (5)
General History (4)	Economics (4)

The relation which the foregoing course in the Agricultural High School bears to the course in the College of Agriculture will be seen from the following outline of the College course:

MINNESOTA COLLEGE OF AGRICULTURE.

GENERAL COURSES IN AGRICULTURE.*

FRESHMAN YEAR.

DIVISION "A."

For graduates in the School of Agriculture.
(Numbers after subject indicate number of hours per week.)

FIRST SEMESTER.	SECOND SEMESTER.
Mathematics (3)	Mathematics (1½)
German (5)	German (5)
Botany or Zoology [long] (3)	Botany or Zoology [long] (3)
Geology (3)	Chemistry (1½)
Horticulture and dairy practicums and debate (3)	Horticulture and dairy practicums and debate (3)
Military drill (2)	Military drill (2)
Rhetoric (3)	Rhetoric (3)
	Drawing (3)

FRESHMAN YEAR.

DIVISION "B."

For graduates of approved high schools or others of equal standing. Students in this division take part of their work in classes of the school of agriculture. For descriptions of these courses see statement under school of agriculture.

First half of first semester.

Farm development (3)	Handling grain and farm machinery (3)
Forestry [September] (3)	Fruit growing (3)
Dairy chemistry [September] (3)	Carpentry (3)
Blacksmithing [September] (3)	Library classification (3)
Agricultural practicums (3)	Field crops (3)
Farm zoology (3)	

AGRICULTURAL SCHOOL YEAR.

FIRST TERM.	SECOND TERM.
Dairy husbandry (2½)	Dairy Husbandry (2½)
Breeding (2)	Feeding (2)
Agricultural chemistry (5)	Soils and fertilizers (5)
Fruit growing (3)	Vegetable gardening (3)
Veterinary (2)	Veterinary (2)
Entomology (5)	Study of breeds (5)
Physics (5)	Plant propagation (3)
Forestry (3)	Military drill (2)
Military drill (2)	Gymnasium (2)
Gymnasium (2)	Economics (3)

LAST HALF OF SECOND SEMESTER.

Chemistry (3)	Farm development (3)
Poultry (3)	Stock judging (3)
Blacksmithing (3),	Live-stock practicums (3)
Farm accounts (3)	Field crops (3)
Dairy stock and judging (3)	

* Taken from the Announcement of the University of Minnesota for 1905-06.

SOPHOMORE YEAR.

Botany or zoology, long, [A] (3)
Botany or zoology, short, [A] (3)
Botany, short, [B] (3)
Zoology, short, [B] (3)
Scientific German or French (3)
Chemistry (3)
Agricultural physics (1½)
Agricultural and Animal husbandry, practicums and discussions (1½)
Rhetoric (1)
Military drill (3)

JUNIOR YEAR.

FIRST SEMESTER.	SECOND SEMESTER.
Industrial botany (3)	Plant pathology (3)
Foods (2)	Animal feeding (3)
Thremmatology (3)	Soils and fertilizers (2)
Agriculture, elective, [A] (3)	Farm management (3)
Taxonomy [B] (3)	Agriculture, elective. [A] (3)
Academic, elective (3)	Academic, elective (3)
Elective (3)	Taxonomy [B] (3)

SENIOR YEAR.

Comparative physiology (3)
Field crops (3)
Farm structures (3)
Elective (3)
Elective (3)
Elective (3)
Veterinary, elective (3)
Stock judging (3)
Horticultural, elective (3)
Elective (3)
Elective (3)
Elective (3)

JUNIOR AND SENIOR ELECTIVES.

AGRICULTURAL ELECTIVES.

Animal taxonomy (3)
Research (dairy, animal husbandry, horticulture and agriculture)
Greenhouse management (2)
Taxonomic botany (3)
Plant ecology (3)
Agricultural engineering (3)
Chemical laboratory practice, courses III, VII, VIII (3)
Animal breeding (3)
Fruit growing (3)
Dairy management (2)
Plant breeding [horticultural] (3)
Plant breeding [agricultural] (3)
Agricultural chemistry, lecture courses IV, V, (2)
Diseases of animals (2)
Bibliography of agricultural literature (3)
Animal parasites (2)
Geology (3)
Bacteriology (1)
Soiling crops (2)
Economic entomology (3)
Land surveying (3)
Seeds and seed judging (3)
Agricultural economics (3)

ACADEMIC ELECTIVES.

Economics (3)
Literature (3)
Language (3)
Elocution (3)
History (3)
Sophomore debate (3)

NEW YORK HIGH SCHOOL COURSE OF STUDY IN AGRICULTURE.

At the request of the New York State Department of Education, representatives of the College of Agriculture of Cornell University prepared the following outline of a one-year's course in agriculture for the high schools of New York State:

AGRICULTURE.*

This outline presents an orderly arrangement of work for a three-period course for one year. It should preferably be pursued in the second year of the high school, after the pupil has completed a year's work in biology. The student must also have some knowledge of elementary chemistry; if this knowledge has not been obtained in the study of biology, one or two weeks should be devoted to it before the specific subjects of the course in agriculture are undertaken. The pupil should have an elementary knowledge of chemical combination and also of the fourteen elements chiefly concerned in the composition of soil and the production of plants and animals: (1) Carbon; (2) hydrogen; (3) oxygen; (4) nitrogen; (5) sulphur; (6) phosphorus; (7) iron; (8) calcium; (9) magnesium; (10) potassium; (11) sodium; (12) chlorin; (13) silicon; and (14) aluminum.

Abundant laboratory work should be provided, at least one period out of the three, every week.

Agricultural operations are conducted for two immediate purposes—to raise plants, and to raise animals. Plants are raised either for their own value or for their use in the feeding of animals. In studying agriculture, therefore, it is well to begin with the plant, then proceed to the animal, and then consider questions of practice and management that grow out of these subjects.

PART I. THE PLANT AND CROPS.

The study of the plant may be provided for under the general heads: (1) The plant itself; (2) the environment that influences or modifies the plant.

Section 1. The Plant Itself.

Under section 1 ,the plant may be studied in relation to (a) composition; (b) structure; (c) physiology; and (d) heredity and plant breeding. On the assumption that the student has covered categories a, b, and c in his work in botany, these subjects are omitted here; therefore only part d, together with a classification of agricultural plants, is outlined here.

*Reprinted by permission from the Annual Report of the Office of Experiment Stations, United States Department of Agriculture, 1905, pp. 342-348.

A. Classification of economic plants.
   (1) Cereals.
   (2) Grasses.
   (3) Legumes.
   (4) Vegetables.
   (5) Fruits.
   (6) Tubers.
   (7) Roots.
   (8) Sugar plants.
   (9) Oil plants.
   (10) Fiber plants.
   (11) Stimulants.
   (12) Medicinal and aromatic plants.
   (13) Timber crops (forestry).
   (14) Flowers and ornamental plants.

B. Heredity and plant-breeding.
   (1) Principles.
   (2) Processes.
   (3) Steps in improvement of plants.
      (a) Variation—environment, crossing.
      (b) Selection.
      (c) Testing hereditary power.
   (4) Illustrations of improvement in plants.
   (5) Methods of improvement.

Section 2. Environment of the Plant.

The subject of environment may be studied under the following heads: (a) Light and heat; (b) air; (c) soil; (d) moisture; (e) applied plant food; and (f) repressive and noxious agencies.

C. Light and heat.
   (1) Relative interdependence.
   (2) Effect.
   (3) Influence of character of light.
   (4) Influence of seasons.
   (5) Temperature for germination and growth.
   (6) How modified: By
      (a) Color.
      (b) Evaporation.
      (c) Topography.
      (d) Character of soil.
      (e) Cultivation.
      (f) Rolling.
      (g) Thickness of planting.
      (h) Fermentation.
      (i) Artificial means—screens, electricity, artificial heat.

D. Air.
   (1) Function above ground.
      (a) Oxygen.
      (b) Carbon dioxid.

(2) Function in soils.
  (c) Oxygen.
  (d) Nitrogen.
  (e) Removal of carbon dioxid.
(3) Processes of soil ventilation.
  (f) By diffusion.
  (g) By expansion and contraction of air due to temperature.
  (h) By expansion and compression due to barometric pressure.
  (i) Suctional effect of gusts of wind.
  (j) Air absorbed by rain water.
  (k) By removal of water through drainage, evaporation, and transpiration of plants.

E. The soil—function of the soil.
  (1) As rootholds and mechanical supports of plants.
  (2) As sources of plant food.

F. The soil—origin.
  (1) Disintegration and decomposition of rocks.
  (2) Erosion, transportation, and deposition of sediment (by water and ice).
  (3) Sorting out of sand, silt, and clay by running water and deposition of soils of different texture as a result of sorting.
  (4) Movement of soils by wind.
  (5) Decay of animal and vegetable materials. Humus.

G. The soil—physical composition.
  (1) Solid matter: Mineral, organic.
  (2) Liquid matter: Impure water or soil solution, air.
  (3) Gaseous matter: Carbonic-acid gas, water vapor.

H. The soil—kinds of soils: Peat, muck, clay, loam, sand, gravel, stony soils.

I. The soil—texture of soils: Relation of texture to air, retention and movement of water, drainage, temperature, weight, and solidity, roothold of plants.

J. The soil—plant food in the soil and air (general survey).
  (1) Elements essential to plant life.
  (2) Elements found in minerals.
  (3) Elements and compounds in air (oxygen, nitrogen, carbon dioxid, ammonia).
  (4) Elements in water (hydrogen, oxygen, and dissolved oxygen).

K. Moisture.
  (1) Purpose.
  (2) Importance.
  (3) Quantity required.
  (4) How modified: By
    (a) Kind of soil.
    (b) Topography.
    (c) Fertilizers and amendments.

(d) Cultivators.
(e) Drainage and irrigation.

L. Plant food.
(1) According to constituents.
(a) Nitrogenous.
(b) Phosphoric.
(c) Potassic.
(d) Amendments.
(2) According to form.
(e) Green manures. Cover crops.
(f) Animal manures. Farm manures.
(g) Commercial manures or fertilizers.

M. Plant food (farm manures).
(1) Properties.
(2) Sources.
(3) Uses.
(4) Preparation, care, and handling.
(5) Application.
(6) Economy.

N. Plant food (commercial fertilizers).
(1) Sources.
(2) Uses.
(3) Application.
(4) Economy.
(5) Offices of the leading elements of commercial fertilizers —nitrogen, potassium, phosphorus.

P. Repressive agencies.
(1) Insects.
(2) Fungus diseases.
(3) Acidity of soil.
(4) Toxic agencies and untoward conditions.

P. Farm crops.

Actual study of the leading crops of the community. The products themselves should be actually handled and studied in school, as ears of corn, beans, wheat (in head and straw if possible), potatoes, oats, fruits, and vegetables. Determine physical characteristics, as weight, size, shape, color, etc. Discuss the methods of growing the crop, its place in the farm scheme, and in the rotation, methods of preparing the land and tillage, fertilizing, harvesting, marketing, insect and fungus enemies, its importance in the community, and history. At least one crop should be thus studied in detail.

PART II. ANIMALS AND ANIMAL HUSBANDRY.

Q. The kinds of domestic animals.
(1) Classification of common domestic animals.
Mammals: Cattle, sheep, swine, horses, asses, mules and dogs.
Birds: Fowls, ducks, geese, pigeons, and turkeys.
Insects: Bees.

(2) Zoological relationships: Origin, history of domestication, purposes for which kept, races, breeds, and varieties of each.

R. Nutrition of domestic animals.
- (1) Relations of plant and animal life.
- (2) The chemical elements of nutrients: Their number and occurrence in plants and animals.
- (3) The compounds of animal nutrients.
  - (a) Water: In living plants, feeding stuffs, the animal. Its occurrence and functions.
  - (b) Mineral matters (ash) in the plant and in the animal. Amount and distribution.
  - (c) The nutrients.

S. Nutrition (continued). The nutrients in detail.
- (1) Protein.
  - (a) Nomenclature.
  - (b) Examples.
  - (c) Composition.
  - (d) Physical characteristics.
  - (e) Variability.
  - (f) Occurrence.
  - (g) Distribution.
- (2) Carbohydrates.
  - (a) Examples.
  - (b) Composition.
  - (c) Physical characteristics.
  - (d) Nitrogen-free extract and crude fiber.
  - (e) Starches.
  - (f) Sugars.
  - (g) Occurrence and distribution.
- (3) Fats and oils.
  - (a) Character and composition.
  - (b) Occurrence and distribution.
- (4) Functions of the nutrients.
  - (a) Protein.
  - (b) Carbohydrates and fat.
  - (c) Relations to one another.
  - (d) Nutritive ratio.
  - (e) Food as a source of energy.
  - (f) Heat relations.

T. The digestion and utilization of food.
- (1) The digestive tract.
- (2) Ferments.
- (3) Conditions influencing digestion.
  - (a) Palatableness.
  - (b) Quantity.
  - (c) Stage of growth of plant.
  - (d) Effect of methods of preservation and storage.
  - (e) Grinding.
  - (f) Addition of salt.

(g) Frequency of feeding and watering.
(h) Determination of digestibility.

(4) Distribution and use of digested food: also elimination of wastes.

U. Foods.
(1) Pasturage.
(2) Forage and fodders: Green and dried fodders, soiling, and silage.
(3) Roots and tubers.
(4) Concentrated feeding stuffs: Grains and seeds, commercial by-products.

V. Rations.
(1) Food requirements of different animals for different purposes.
(a) For maintenance.
(b) For work.
(c) For growth (young animals).
(d) For flesh (fattening).
(e) For milk, eggs, wool, etc.
(2) Combination of fodders into rations.
(f) Amount of nutrients.
(g) Amount of water (succulence).
(h) Relative proportions of protein and nonprotein (nutritive ratio).
(i) Palatableness.
(j) Effect on product.
(k) Economy.

W. Animal products.
(1) Flesh: Beef, mutton, pork, poultry; relation; composition; quality as determined by age and condition of animal; relative suitability as food for man; economy.
(2) Eggs: Composition; quality as affected by food of fowl; methods of preservation; economy.
(3) Milk.
(a) Source; kind of animal; physiology of secretion; methods of milking.
(b) Quality: chemical and physical properties: natural variations as affected by animal, by food, by environment, by adulteration.
(c) Determination of specific gravity, fat, organisms, impurities, adulteration.

X. The animal. (The animal form as related to production).
(1) Animal mechanism in relation to speed and force, types of animals for production of milk and beef, wool and mutton, eggs and flesh. Correspondence of individual to type. Standards or scales of points; methods of scoring.
(2) Selection of animal with reference to future generations; heredity; variation; evolution of modern forms from simpler types.

PART III. FARM SCHEMES AND MANAGEMENT.

Y. Farm schemes.
- (1) Kind of farming.
- (2) Rotations, considered as to history, principles, and systems.
- (3) Lay-out of farms, as to arrangement of fields, lanes, water supplies, and buildings.

Z. Farm practice.
- (1) Tillage.
  - (a) Purpose and effects.
  - (b) Methods.
- (2) Drainage.
  - (c) Purpose and effects.
  - (d) Methods.
- (3) Irrigation.
  - (e) Purpose and effects.
  - (f) Methods.

PROGRAM FOR HIGH SCHOOLS OF INDIANA, SUGGESTED BY THE SUPERINTENDENT OF PUBLIC EDUCATION.*

FIRST YEAR.

General Course.	†	Tentative Agricultural Course.	†
English	5	English	5
Algebra	5	Algebra	5
Physics and Chemistry	5	Physics	5
Latin	5	Plants and their cultivation (i. e., botany, general and economic)	5

SECOND YEAR.

English	5	English	5
Algebra and Geometry	5	Algebra and Geometry	5
History	5	Chemistry	5
Latin	5	Animals and their management(i.e., zoology—general and economic)	5

THIRD YEAR.

English	5	English	5
Geometry (two-thirds year) / Elective (one-third year)	5	Geometry, Latin, or German	5
History	5	History	5
	5	Agronomy (with special attention to local crops)	5
History	5	History	5
Latin	5	Latin or German	5
Zoology or Botany	5	Zootechny or dairying	5
Elective ‡	5	Political economy	5

With the introduction of agriculture into high schools of this kind, the division of studies among three teachers might be as follows: A, chemistry, botany, zoology, agriculture; B, English, Latin, German; C, physics, mathematics, history, political economy.

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† The figures indicate the number of hours per week devoted to the study.

‡ Mathematics, physical geography, oratory, or advanced physiology.

SUGGESTED COURSE IN AGRICULTURE FOR TEXAS HIGH SCHOOLS.

Just what courses in agriculture would best be offered in any given high school would depend so largely upon the local situation that any definite outline of a course of study suited to all is manifestly impossible. The large high school with well equipped laboratories for physics, chemistry, and biology and with departments of manual training and domestic economy can easily offer courses impossible to the small and poorly-equipped high school with only three teachers. Merely to indicate how easily the courses in agriculture may be fitted into the regular high school work as offered in Texas, we print below the three courses now offered in the Sherman high school together with a suggested agricultural course.

This agricultural course must be elastic enough to meet the needs of three classes of students: First, those who will complete the three years' high school course and go into active life as farmers; second, those who are preparing for the higher work of the A. and M. College; third, those who can remain in school only one or two years. The first class would do best to follow the order given in the outline. Those who will attend an A. and M. College might very well omit the economics and civil government in the second year and the agricultural chemistry in the third year, taking two years of German instead, if the school affords a good German teacher. A new foreign language is easier to master at this age than later, while the economics, civil government, and agricultural chemistry will be better appreciated if taken in the more mature college years. Those who can remain only one year and must prepare for immediate service on the farm could well omit the algebra and put the economics and civil government or the carpentry and drawing in its stead. Other substitutions of similar nature could be made, bringing back into the first two years practically all of the special agricultural courses, thus covering the field of the narrow special agricultural high school. Needless to say, this is highly undesirable, but better than setting the children who study agriculture off entirely by themselves in a separate school. The effort has been made in this outline to teach enough of a few subjects to make them really worth while, instead of scattering over a large number and teaching very little of each. The agricultural student is here offered no foreign language, ancient or modern, unless he be preparing for advanced work, but he has three full courses in history, three full courses in the English language and literature, three courses in mathematics, five courses in agriculture and applied science, and a course in economics and civil government. Where a four-year course is offered, the same and related subjects should be still further pursued, not more than one new subject being introduced.

Latin Course.	Science Course.	Manual Training Course.	Proposed Agricultural Course.
FIRST YEAR.			
Algebra. U. S. History. English Grammar, Composition and Rhetoric. Latin. Arithmetic and Physiology.	Algebra. U. S. History. English Grammar, Composition and Rhetoric. Botany. Arithmetic and Physiology.	Algebra. U. S. History. English Grammar, Composition and Rhetoric. Latin or Botany. Manual Training and Drawing.	Algebra. U. S. History. English Grammar, Composition and Rhetoric. Arithmetic and Physiology. Plant growth and cultivation, soils and fertilizers, and economic insects.
SECOND YEAR.			
Algebra and Geometry. Physical Geography and Civil Government. Composition, Rhetoric and American Literature. Latin. English History.	Algebra and Geometry. Physical Geography and Civil Government. Composition, Rhetoric and American Literature. Zoology. English History.	Algebra and Geometry. Physical Geography and Civil Government. Composition, Rhetoric and American Literature. Latin or Zoology. Manual Training and Drawing.	Algebra and Geometry. Economics and Civil Government (or German). Composition, Rhetoric and American Literature. English History. Animals and Animal Husbandry.
THIRD YEAR.			
Geometry. English Literature. General History. Physics. Latin.	Geometry. English Literature. General History. Physics. Psychology.	Geometry. English Literature. General History. Physics. Manual Training and Drawing.	Carpentry and Drawing. English Literature. General History. Agricultural Chemistry (or German). Rural Engineering and Rural Geometry.

A VILLAGE AND A COUNTY HIGH SCHOOL.*

"In Erie county, Pa., surrounded by a good general farming and dairy country, is the village of Waterford. * * * The township of Waterford has a population of 1460, and about half of these (770) reside in the borough of Waterford. The borough has its own elementary school, but the high school is supported and controlled jointly by the borough and township.

"This high school, with its three teachers and three courses of study (language, scientific, and agricultural), has an enrollment of eighty pupils, and thirty-five of these are in the agricultural course. This course includes agriculture five hours a week for four years. The work of the first year is devoted to a study of plant life—germination, plant growth, plant food, reproduction, propagation, transplanting, pruning, and uses of plants; the second year to a study of field, orchard, and garden crops; the third year to domestic animals, dairying, and soil physics, and the fourth year to the chemistry of soils and of plant and animal life. Text-books are used in the class room; a small library of agricultural reference boks, reports and bulletins of this department and experiment stations, and agricultural papers contributed by the publishers is in almost constant use, and lectures on agricultural subjects are given before the class and before the whole school by the instructor in agriculture, who is an agricultural college graduate. But the feature of instruction which chiefly distinguishes this agricultural course from the ordinary high school course is the prominence given to the laboratory work and the outdoor practicum. For the laboratory work there is no elaborate apparatus. The pupils make much of their own apparatus, furnish their own reagent bottles, and, moreover, use them. In the plant-life course the pupils study not elaborate and carefully prepared drawings, but the plants themselves with reference to their life history and economic uses.

"For the outdoor practicum the school is unfortunate in having neither land nor domestic animals nor fowls, and yet it has a wealth of illustrative material all around it. Every good farm within a radius of three or four miles, nearly every barn and poultry yard in the village, the butcher shops, and the farm implement stores furnish costly illustrative material and extend vastly the teaching force of the high school. The farmers and other owners of good live stock either bring their animals to the door of the school house to be studied by the class in agriculture or allow the class to go to their barns and fields for this purpose. It is said to be a rare thing for a good horse to come to the village and get away without being examined by the high school class in animal husbandry.

"The writer was fortunate in being the guest of the school one day last October and in having an opportunity to listen to some of the recitations in agriculture. A class of fourteen boys and six girls was studying

*Taken by permission from the pamphlet on The Uses of Illustrative Material in Teaching Agriculture in Rural Schools, by Dick J. Crosby; reprinted from the Yearbook of the United States Department of Agriculture, 1905.

animal husbandry. It had been organized only three or four weeks, and yet the interest manifested and the readiness with which the boys and girls described the beef type, the dairy type, and various breeds of cattle, the mutton and wool types of sheep, the principal breeds of draft horses, and some of the standard-bred roadsters and trotters, were indeed surprising. At the close of the recitation the class was taken to a barn in the village, where several fine roadsters were owned. The owner was not at home, but the teacher had standing permission to take the horses from the barn in order that the class might examine them. A fine Hambletonian mare was led into the yard and examined critically by the pupils and criticised by them, the different points being brought out by skillful questioning on the part of the teacher.

"From this place the class went to a livery barn where a splendid black Percheron stallion was stabled for the day. A member of the class had discovered the horse as he was being driven in from another town fourteen miles away, and following the driver to the barn had got permission for the class to examine him. When the livery barn was reached the driver brought his stallion out into the street, put him through his paces, helped the teacher in calling attention to his good points and the contrasts between the draft type and the roadster type of horses, and allowed us to take several photographs. It was an instructive lesson not only for the members of the agricultural class, but for the score or more of farmers and townsmen who collected around the livery stable. In much the same way the local butcher is an instructor in the high school. The class studying the beef type of cattle, or the mutton sheep, or the different classes of swine is taken to the butcher shop and given a demonstration lesson on cuts and their relative values, which of the breeds are apt to produce the better cuts, which the better quality, and so on."

A COUNTY HIGH SCHOOL.*

"Kansas has local option in the establishment of county high schools. As a result several sparsely-settled counties, or counties in which there are few large towns, are supporting such schools. Norton county, which a few years ago was dotted with sod school houses, and which still has many sod dwelling houses, now supports a good county high school in the village of Norton, a town of about 1500 inhabitants, located near the geographical center of the county. The high school building is of brick, two stories high, over a well-lighted basement, and is located on the outskirts of the village, where land can be easily secured. The basement contains furnace and fuel rooms, lavatories, and a gymnasium. On the first floor is a physics and chemistry room, a natural history room, a music and art room, and the rooms of the business department. The second floor contains an assembly and study room and two recitation

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rooms. The apparatus and other equipment for the work in physics, chemistry, and natural history are exceptionally good for a small high school. There is also a good library and a reading room with current newspapers and magazines. Heretofore five teachers have been employed, but this year there are six.

"Previous to this year the Norton County High School has offered college preparatory, normal, business, and general science courses, but no courses related in any direct way to the leading industry of the county—farming. The county superintendent of schools said that his attention had been forcibly directed to this lack in the curriculum of the high school. * * * So the county superintendent of schools and the other members of the board of trustees decided that an agricultural course should take the place of the general science course, and hired a graduate of the Kansas State Agricultural College to teach agriculture and other sciences in the high school. * * * Considerable interest was aroused in the proposed new work, a tentative agricultural course was outlined, and arrangements were made with the three farm implement dealers of the town to open their warehouses to the classes in agriculture and furnish experts to give instruction on the mechanics, care, and use of farm machinery.

"The agricultural work of the course will include botany, with special reference to variation, development of species, hybridization, and the influence of light, heat, moisture, etc., on the plant; soils and tillage; plant physiology, farm crops, grain judging, and horticulture; farm accounts; farm management, including farm plans, methods of cropping, farm machinery and its care, and rural economics with special reference to the problems of a business nature that will be met on the farm; animal production and stock judging, and dairying. The teacher of agriculture reports that the implement dealers have given further evidence of their interest in the agricultural course by offering prizes aggregating $112 in value for a grain-judging contest, open to all young men in the county. * * *

"The county superintendent of schools has expressed the hope that the school may also do much work that will be of immediate practical benefit to the agriculture of the county, such as testing seeds for viability, or germinating power, and milk and cream for butter fat; treating oats and wheat for smut and potatoes for scab; spraying trees and garden crops for insect pests and diseases, and making plans for farm buildings, roads, water systems, etc. Such work could be done largely by the pupils at school or on the different farms on Saturdays. It would be educational and at the same time would make the farmers feel that they were getting some immediate tangible return for the taxes paid in support of the school."

SYLLABUS OF ELEMENTARY COURSE IN AGRICULTURE.*

I. PLANT PRODUCTION.

- 1. THE PLANT.
  - Structure
  - Physiology—how plants
    - Feed
    - Grow
    - Reproduce by
      - Seeds — Trace life history from seed to seed, noting pollination, crosses, hybrids, etc.
      - Bulbs
      - Cuttings
      - Grafts
      - Buds
- 2. THE ENVIRONMENT OF THE PLANT.
  - Climate
    - Light
    - Heat
    - Moisture
    - Air

    Study these in relation to plant growth
  - Soil
    - Nature and functions
    - Origin
    - Properties — Distinguish between light and heavy soils, porous and impervious soils, soils that bake and those which do not, etc.
    - Classification — Main classes, such as sand, clay, loam, peat, silt
    - Temperature
    - Aëration
    - Moisture
    - Management
      - Tillage
      - Drainage
      - Irrigation
      - Enrichment
        - Farm manures
        - Commercial fertilizers
      - Impoverishment
      - Cropping—rotation

*From Circular No. 60, issued by the United States Department of Agriculture, December, 1904; published by permission. In this syllabus the same general arrangement of topics has been made as in the higher courses outlined by this committee, but it is of course to be understood that the treatment of these topics by the teacher in the common school should be brief, simple, and elementary.

- 3. FARM CROPS
  - Classification: Include only the most general classes, such as cereals, grasses, legumes, tubers, etc.
  - Individual crops. (Study one or more of the leading crops of the region.)
    - Name
    - Place in classification
    - Varieties
    - Culture
      - Preparation of soil
      - Selection of seed
      - Planting
      - Cultivating
      - Protection from pests
        - Weeds
        - Diseases
        - Insects
        - Birds
        - Mammals
      - Harvesting
      - Marketing
- 4. FRUITS: One or more of the leading fruits of the region should be studied in the same manner as farm crops.

II. ANIMAL PRODUCTION.

- 1. DOMESTIC ANIMALS—THEIR TYPES AND BREEDS
  - Horses
    - Draft
    - Trotting
    - Roadsters, etc.
  - Cattle
    - Dairy
    - Beef
  - Sheep
    - Wool
    - Mutton
  - Swine
  - Poultry
  - Bees

  Bring out leading characteristics of one or two leading breeds of each type represented in a given region.
- 2. CARE AND MANAGEMENT OF DOMESTIC ANIMALS
  - Feeding: Only the most general statements regarding the food requirements of different animals and for different purposes, and exercises in compounding rations suitable to a given region
  - Hygiene
    - Water supply
    - Exercise
    - Shade
    - Condition of inclosures as to
      - Comfort
      - Ventilation
      - Cleanliness
  - Preparation and care of product
  - Marketing product

III. DAIRYING.

- 1. THE DAIRY COW
  - Type: A more detailed study of the dairy type than was given under animal production
  - Feeding, care, and management

2. MILK
- Composition
  - How determined
  - Relation to price
- Handling
  - Cleanliness
    - Stables
    - Cows
    - Attendants
    - Vessels
    - → Relation to souring or tainting of milk
  - Straining
  - Aërating
  - Cooling
- Uses
  - For consumption as milk or cream
    - Putting up in cans or bottles.
    - Marketing
  - For condensing
    - Putting in cans and hauling
  - For cheese making
  - For butter making
    - Creaming
      - By setting in pans
      - By use of separator
    - Churning
      - Temperature
      - Kinds of churns
    - Salting
    - Coloring
    - Working
    - Marketing

IV. RURAL ENGINEERING.

It is not thought that the pupils in a rural common school will be prepared to study the problems involved in rural engineering from the viewpoint of the engineer, but it is hoped that there will be some opportunity to examine the plans and structure of good types of buildings, fences, roads, etc., and to devote some time to drawing simple plans of farms, buildings, and other works. The importance of good roads, hygienic water supply and sewage disposal, and of caring for farm machinery should be emphasized.

1. FARM PLANS
- Size and location of fields
- Location of buildings, fences, drains, and roads

2. CONSTRUCTION OF BUILDINGS AND WORKS
- Buildings
  - House
  - Barn
  - Outbuildings
  - Fences
- Water system
- Sewage system
- Roads
- Irrigating system
  - Only in regions where irrigation is practiced

3. FARM MACHINERY	Interesting facts regarding the development of farm machinery in a way to encourage the more general use of improved macinery	
	The importance of caring for and repairing farm machinery	

V. RURAL ECONOMICS.

Most of the topics under rural economics are too broad to be included in a brief course in agriculture, or too complex for the comprehension of common school pupils. It is thought, however, that some of the general principles of marketing and farm accounts might be taught in this connection. The main factors in marketing will probably be best considered in connection with the disposal of particular products as indicated above under plant production; animal production, and dairying. The following topics are appropriate for this course:

1. MARKETING	Preparation for market	
	Choice of market	
	Transportation	
	Method and cost of sale.	
2. FARM ACCOUNTS	Feed and milk records	This to include only the most general suggestions and a discussion of the importance of keeping full and accurate records
	Crop records	
	Breeding records	
	Inventories	
	Bookkeeping	

A. C. TRUE,
H. H. WING,
T. F. HUNT,
H. T. FRENCH,
J. F. DUGGAR,
Committee.

Recommended for publication.
A. C. TRUE, *Director.*

Publication authorized.
JAMES WILSON, *Secretary of Agriculture.*

WASHINGTON, D. C., *December 19, 1904.*

EXPERIMENTS AND ILLUSTRATIVE MATERIAL FOR TEACHING ELEMENTARY AGRICULTURE IN RURAL SCHOOLS.

In order to illustrate concretely the simple yet interesting and valuable experiments which can be performed in the course in elementary agriculture by regular teachers in ordinary rural schools, and to show how very inexpensive the physical equipment for such work is, we give below a few suggestions about apparatus, and seven concrete experiments with illustrations of apparatus, all taken by permission from the valuable article by Dick J. Crosby, in the 1905 Year Book of the Department of Agriculture.[1]

MATERIALS NEEDED.

"Two dozen empty tomato cans, three or four lard pails, a few baking powder cans and covers, a lot of empty bottles, a few small wooden boxes, a collection of typical soils (clay, sand, loam, and muck or peat), and a few seeds of garden and farm crops will enable the teacher and pupils to perform a variety of experiments illustrating important principles upon which the science and practice of agriculture are based, and will not cost a cent. If to this material the school board or the pupils will add by purchase an eight-ounce glass graduate (10 cents), four dairy thermometers (60 cents), six student lamp chimneys (30 cents), one hundred five-inch filter papers (15 cents), a pint glass funnel (10 cents), a four-bottle Babcock milk tester with test bottles, pipette acid measure and acid ($5), an alcohol lamp (25 cents), a kitchen scale with dial which will weigh from one ounce to twenty-four pounds (90 cents), twelve ordinary glass tumblers (30 to 50 cents), a small quantity of litmus paper, and a few ordinary plates, pie tins, etc., the school will be provided with an excellent equipment for laboratory exercises, and all at a cost of less than $10.

PHYSICAL CHARACTERISTICS OF SOILS.

"With this material in the hands of the pupils and a teacher willing to experiment and learn with the pupils the ordinary rural schoolroom becomes a laboratory in which it is possible to determine the comparative temperature, weight, acidity, porosity (exercise 3), capillarity (exercise 4), and fertility of different soils; to test their water holding capacity and the readiness with which they may be drained, and to show the effects of cultivation, mulching, and puddling on the moisture content and physical condition of different soils. As far as the training of the pupil in mathematics will permit, the results obtained in the laboratory exercises should be translated to field conditions, and the importance of

[1]The Uses of Illustrative Material in Teaching Agriculture in Rural Schools, by Dick J. Crosby, in Yearbook of the Department of Agriculture, 1905.

the principles involved should be brought out by questions concerning their application to the practical operations of farming.

EXERCISE 1.—*To make a farm-level.*

"A cheap but serviceable farm-level can be made as shown in figure 71. It should be four to five feet high, with a crossbar about three feet long. Small glass tubes are tied to the ends of the crossbar and connected by a piece of rubber tubing four or five feet long. The tubing is filled with water (colored water is better) up to the line A B. When the instrument is set so that the line A B exactly corresponds with the

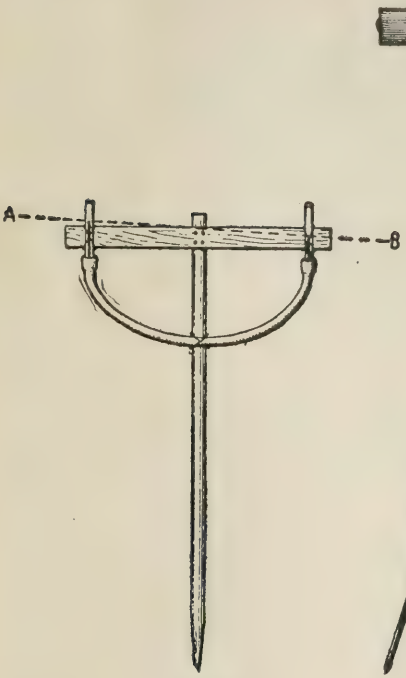

Figure 71.

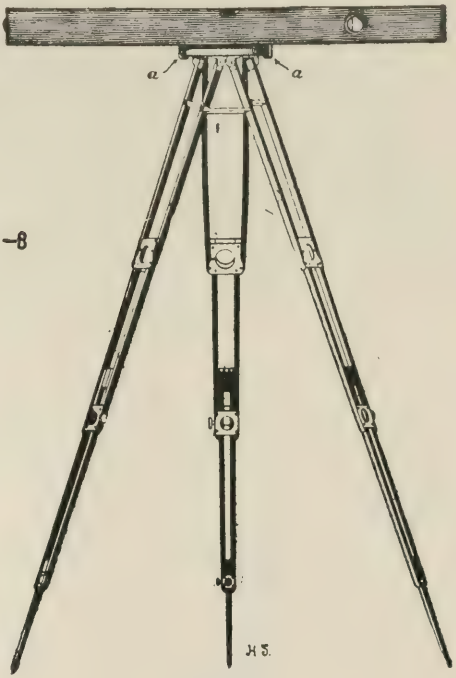

Figure 72.

upper edge of the crossbar, the latter will be level. Such an instrument will cost not over 50 cents, and will be as accurate and nearly as convenient as a farm-level costing $15 to $25.

"A more convenient farm-level can be made by fastening a thirty-inch carpenter's level, costing about $1.25, to the head of an ordinary camera tripod. Make the fastening by means of two right-angled screw hooks, as shown at *a* in figure 72.

EXERCISE 2.—*Germination test of seeds.*

"Count out fifty or one hundred seeds of the kind to be tested* and place them in a plate between two folds of moistened canton flannel or

*(a) In official germination tests 100 seeds are used of peas, beans, corn, and other seeds of similar size, and 200 seeds of clover, timothy, cabbage, wheat, and other small seeds.

thin blotting paper (fig. 73). On a slip of white paper record the

Figure 73.

variety, number of seeds, and the date, then place it on the edge of the plate. Cover the whole with another plate or a pane of glass to prevent too rapid evaporation of moisture. Set the plate in a warm room (68° to 86° F.) and examine the seeds every twenty-four hours for six or eight days.* If they get too dry add enough water to moisten, not saturate, the cloth or blotting paper. At the end of the test count the sprouted seeds and from them determine what percentage of the whole number of seeds are good. With large seeds no difficulty will be experienced in using the folds of canton flannel, but with small seeds the blotting paper is better.

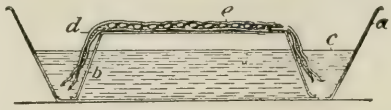

Figure 74.

"Another seed tester (fig. 74) is made by inverting a small tin basin (*b*) in a larger basin (*a*) and covering the small basin with a piece of clean cloth large enough to dip into the water (*c*) at each end. Place seeds on the cloth and cover with another cloth as shown at *d*, *e*. How does moisture get to the seeds?

EXERCISE 3.—*Porosity—the capacity of soils to take in rainfall.*

"Break the bottoms off five long-necked bottles,† tie a small piece of cheese cloth or thin muslin over the mouth of each and arrange them in a rack with a glass tumbler under each, as shown in figure 75. Fill the bottles to about the same height with different kinds of soil—gravel in one, sand in another, etc., and firm the soils by lifting the rack and jarring it down moderately three or four times. Now, with watch or clock at hand, and with a glass of water held as near as possible to the soil, pour water into one of the bottles just rapidly enough to keep the surface of the soil covered and note how long before it begins dropping into the tumbler below. Make a record of the time. Do likewise with each of the other bottles and compare results. Which soil takes in water most rapidly? Which is the most porous? What happens to the less porous soils when a heavy shower of rain comes? How can a soil be

*For most seeds six days are enough for the test, but beets, buckwheat, cotton, cow peas, onions, redtop, tomatoes, and watermelons should be allowed to remain eight days; salsify and spinach ten days; carrots, celery, parsnips and tobacco fourteen days, and bluegrass and parsley twenty-eight days.

†To break the bottom off a bottle, file a grove in the bottle parallel with the bottom. Heat a poker red hot and lay it in the groove. As soon as a small crack starts from the groove draw the poker around the bottle and the crack will follow.

made more porous? Repeat the experiment with one of the soils, packing the soil tightly in one bottle and leaving it loose in the other. What is the effect of packing? Does this have any bearing on farm practice?

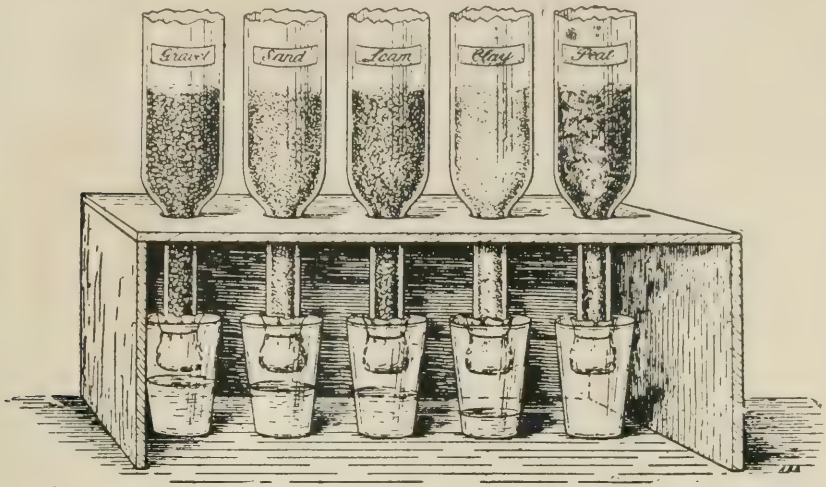

Figure 75.

"Which soil has the greatest capacity for water—that is, which could take in the heaviest shower? This can be determined from the above experiment by emptying and replacing each tumbler as soon as all free water has disappeared from the upper surface of the soil above it. After water has ceased dripping from all the bottles measure and compare the water in the different tumblers. Which soil continued dripping longest? Which would drain most readily?

"Which soil would store up the greatest amount of moisture for the use of plants? This can be determined from the same experiment by weighing each bottle before and after filling it with dry soil, and again after water has entirely ceased dripping from it. The difference between the weight of the dry soil and that of the wet soil is the weight of water stored. During the time that the bottles are dripping, which may take several days, they should be covered to prevent evaporation of water from the surface of the soils.

"Make other practical applications of the principles brought out in this exercise.

Exercise 4.—*Capillarity, the power of soils to take up moisture from Below.*

"Arrange four or five student lamp chimneys, as shown in figure 76, and tie cheese cloth or thin muslin over their lower ends. Fill each with a different kind of dry soil, as in exercise 3. Pour water into the pan beneath until it stands about half an inch above the lower end of the chimneys, then observe the rise of water in the different soils. Make notes on the height to which the water rises, and on the time it takes.

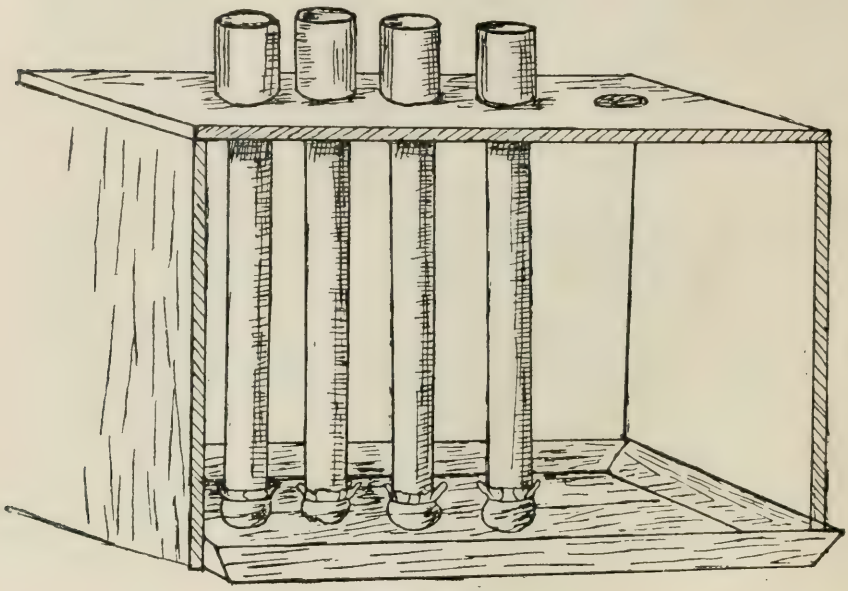

Figure 76.

In which soil does the water rise most rapidly; in which to the greatest height? Which soil draws up the greatest amount of water? How can this be determined? This power of soils to raise water from below is called capillarity. It is an important function, for by it plants are able to get moisture and plant food from the subsoil in times of drought.

"If the chimneys are not to be had, this experiment can be performed with the apparatus shown in figure 75 by substituting the pan for the tumblers; or the experiments performed with the bottles can be performed with the chimneys and tumblers.

"If more accurate tests of capillarity are desired it will be necessary to procure a series of glass tubes at least three feet high, for in some soils water will rise to that height, or even higher.

RELATION OF SOILS TO PLANTS.

"It will be perfectly feasible also to arrange exercises showing the relation of the physical characteristics of soils to plant growth—that plants need moisture in the soil; that they take up this moisture (exercise 5) and give off a part of it through their leaves (exercise 6); how much moisture is taken from the soil by a given plant; that too much moisture is injurious to plants; how the root hairs of plants absorb moisture; the best depth at which to plant different seeds in different soils (exercise 7); the effect of cultivation on plant growth, and a dozen other things important for the farmer to know and interesting as experiments for school children.

"Seed testing has already been referred to. It is highly important that farmers should know that they plant good seed in order that all of the land they plow, plant, and cultivate may at least have a chance to make some return for the labor bestowed upon it. It is estimated that

in the summer of 1905 the farmers of Iowa increased their corn crop several million bushels merely by giving better attention to the quality of seed planted. It would not be a difficult matter to teach every boy in school the process of testing seed, nor to impress upon him the practical importance of this work. Testing the viability of seeds would lead naturally to other studies in propagation, such as making hard and soft cuttings, layering, grafting, and budding, all of which are clearly described in bulletins of this Department and in other publications which teachers can procure without cost.

Exercise 5.—*To show that plants absorb moisture from the soil.*

"Thoroughly pulverize and sift enough good garden soil to fill two flower pots of the same size. To get the same amount of soil into each pot it should previously be weighed or carefully measured. Plant several kernels of corn in one pot, water both, and set them aside for the corn to grow. Whenever water is applied to the pot containing the corn an equal amount should be applied to the other pot, in order that both soils may be packed alike. When the corn is two or three inches high get two lard pails just large enough to take in the pots to their rims, as shown in figure 77. Mark on the outside of the pails the depth to which the pots will extend on the inside, and at a point one inch above each mark make a dent which can be distinctly seen on the inside of the pail. Now fill each pail with water up to the dent, water both pots thoroughly, and set them in the pails as shown in the figure. Set both pails and

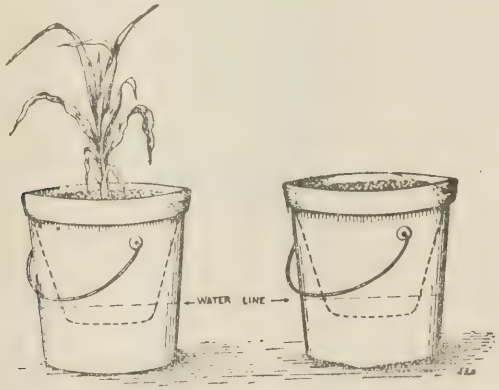

Figure 77.

pots in a warm, light place so that the corn will continue to grow. The next day remove the pots, and you will probably find that the water is not up to the dents. What has become of it? From a previous experiment you will probably conclude that the soil has taken it up. From an eight-ounce graduate pour into one pail just enough water to bring it up to the dent again. Make a record of the amount necessary to do this. Fill the graduate and bring the water in the other pail up to the dent. Again record the amount of water used. Repeat these operations daily for two or three weeks. Find the total amount of water added

to each pail. You will probably find that the pot containing the corn has taken up considerably more water than the other pot. Why? Was there any place for the water to escape except through the soil and the corn? How much water did the corn use? What became of this water? The next exercise will show what became of a part of it.

EXERCISE 6.—*To show that plants give off moisture.*

"Take a plant that is well started in a tomato can or flower pot, a piece of cardboard, and a glass tumbler or jar large enough to cover the plant. Cut a slit in the cardboard and draw it around the plant as shown in figure 78. Seal the slit with pitch, wax, or tallow so that no moisture can come up through it from below; cover the plant with the glass and set it in a warm, sunny place. Moisture will condense on the inner surface of the glass. Where does it come from? Is all the moisture absorbed by the roots given off in this way? How can you find out? Why do plants need water?

EXERCISE 7.—*Depth of planting.*

"To determine the best depth at which to plant corn take an olive bottle about eight inches high, or other similar glass vessel. Fill it with garden soil to a height of five or six inches from the top, put in a kernel of corn flat against the side of the bottle, put in another inch of soil,

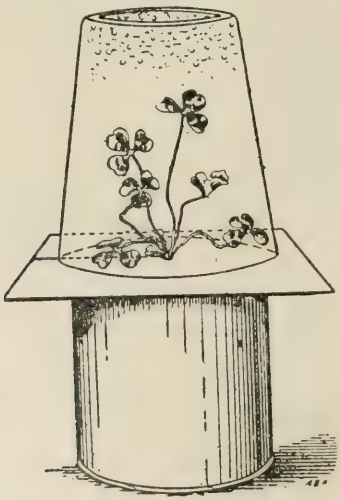

Figure 78.

then another kernel of corn, and so on until the bottle is full, arranging the kernels spirally as shown in figure 79. Moisten the soil, wrap the bottle up to the neck in black paper or cloth, and set it in a warm place. Prepare other bottles in the same way, but plant in them beans, peas, and some small seeds, such as those of radishes, onions, and lettuce. By taking off the wrappings and looking at the seeds daily you can not only determine the best depth at which to plant different seeds, but make

many interesting observations regarding the rate of germination, how the little plants push out of the ground, whether they take the seeds up with them or leave them behind, etc. Take careful notes and try to determine whether large or small seeds should be planted deeper, whether the roots or the little plants are formed first, whether the plants ever start down or the roots up.

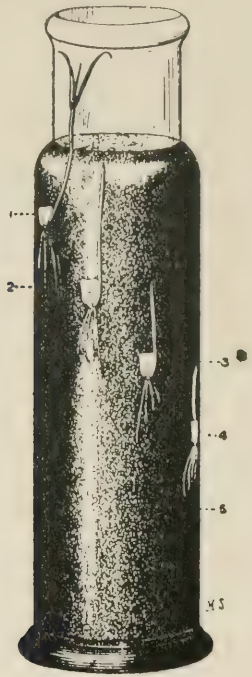

Figure 79.

STUDIES OF MILK.

"The extent to which milk enters into the regular diet of a large percentage of the inhabitants of both urban and rural communities renders it almost imperative that some instruction concerning the importance of sanitary methods of handling milk be given in the public schools. In rural districts a number of inexpensive and simple experiments could be arranged to show the effect of different methods of milking, cooling, aerating, bottling, shipping, and other processes in the handling of milk upon its purity, flavor, odor, and keeping qualities (exercise 8). If the school is provided with a Babcock milk tester, the pupils could determine the relative value of different cows for the production of cream and butter, also the relative efficiency of different methods of separating cream from the rest of the milk.

EXERCISE 8.—*To show the effect of cleanliness on the keeping quality of milk.*

"Provide one of the boys with two pint bottles which have been cleansed thoroughly, scalded, and plugged with clean cotton batting (absorbent cotton is better), and instruct him as follows: Take the bottles home and at milking time select a cow which has stood in the stable several hours and has not been cleaned. Milk a quart or two of milk into a pail in the usual way and set it aside. Then clean the sides and udder of the cow by first brushing and then wiping with a damp cloth. Wash the hands thoroughly, remove the cotton plug from one of the bottles, fill the bottle to the neck by milking directly into it, and immediately replace the cotton plug. Mark this bottle A. Now carry the milk in the pail to the milk room, strain it in the usual way, and from it fill the other bottle, removing and replacing the cotton plug as before. Mark this bottle B. Set both bottles over night in the room where the milk is usually kept, and the next morning bring them to school. Remove the plugs and note whether any odor has developed in either bottle. Pour a small quantity of milk out of each bottle and replace the plugs. Taste the samples. Is there any bad flavor? Test them with litmus paper to see if either is getting sour. Set the bottles in a moderately cool place, and examine them as above, morning and evening, for several days, making notes on any changes that take place in either. Does cleanliness have any effect on odor? On flavor? On acid formation?

"Repeat this experiment, cooling bottle A immediately after filling and treating B as before. Does the cooling affect the keeping quality of milk?

"By keeping accurate temperature records and careful notes on changes occurring under different conditions, the above exercise may be made to yield quite accurate data regarding the proper methods of handling milk."

BIBLIOGRAPHY.

The literature on agricultural education is now large, and the number of text-books on agriculture is rapidly increasing. The quality of these text-books has greatly improved in the last few years, so that now, by combining the use of one of the texts suggested below with exercises and other material gotten from reading one or two other texts and a few Department of Agriculture Bulletins, it is possible for a regular teacher to give, with moderate labor, an interesting and valuable course in elementary agriculture, though he be neither a graduate of an agricultural college nor an agricultural expert. The small bibliography given below makes no pretense at being complete, nor does it contain all even of the meritorious books on the subject. With the exception of a few books taken from the list recommended by the New York State Department of Education, we have included only such books and pamphlets as we have personally examined and found meritorious.

Agriculture for Beginners, by Burkett, Stevens and Hill. Ginn & Co., Boston; price, 75 cents.

This is a very simple and practical little book, well illustrated and well suited to the needs of ordinary rural schools and rural school teachers. It contains suggestions for many valuable and interesting experiments which may be done with very simple and inexpensive home-made apparatus. If a teacher can have only one book, this is perhaps as good as any, and covers the field fairly well.

First Principles of Agriculture, by Goff and Mayne. American Book Co. Price, 80 cents.

Adapted to school use, with valuable experiments, references and tables.

Principles of Agriculture, by L. H. Bailey. The Macmillan Co., New York. 300 pp.; price, $1.25.

This is not so simple as the first book mentioned, but is easily understood by an average rural teacher and will give many helpful suggestions and much valuable information. It covers nearly the same ground as the first book.

Rural School Agriculture, by W. M. Hays, Department of Agriculture, University of Minnesota. 196 pp.; price, 60 cents.

This little book contains 237 simple but valuable and interesting exercises in agriculture, manual training, and domestic economy suited to rural schools. The arrangement of these exercises is not systematic enough to enable a teacher to follow them in teaching a course in agriculture, but the wealth of concrete material and helpful suggestions in this book exceeds that of any of the regular text-books gotten out by the publishing houses. This work was issued as a Bulletin by the University of Minnesota. Every teacher should have this for constant reference.

Nature Study and Life, by C. F. Hodge. Ginn & Co., Boston. Price, $1.50.

This book of 514 pages is full of delightful reading, interesting cuts, and helpful suggestions for one offering a course in nature study or elementary agriculture. It is unique.

How to Make School Gardens, by H. D. Hemenway. Doubleday, Page & Co. 170 pp.

This contains many illustrations and would be very helpful and suggestive to a teacher. The chapters are as follows: How to make a school garden; How to prepare and fertilize the land; Lessons in garden work; Lessons in greenhouse work, planting seed, potting, shifting and taking cuttings; root grafting; Budding; concluding with a full and valuable bibliography of school gardening.

The six books given above would be perhaps about as good a small collection as a teacher could buy, and certainly is a collection furnishing an abundance of most interesting reading, observation and experimentation, both for teacher and pupil. Next after these, should be secured a number of Bulletins and outlines of courses of study issued by the U. S. Department of Agriculture and by several of the State Education Departments. The majority of these can be gotten free, and the others at almost nominal cost. The U. S. Department of Agriculture has an

especially large number of excellent Bulletins and Circulars which serve to instruct one in proper methods of teaching agriculture and to furnish valuable subject matter to teach. The Department will send free of charge the full "*List of Bulletins and Circulars issued by the U. S. Department of Agriculture and Available for Free Distribution.*" There are several hundred of these pamphlets on agriculture listed here which are of the highest value for teachers and should be procured. The Department will also send free the list of *Publications of the U. S. Department of Agriculture for Sale by the Superintendent of Documents.* Union building, Washington, D. C. Many of the several hundred Bulletins here listed are very valuable for the teacher, and are sold at a very small price. In addition to these Bulletins and Circulars one should ask for a copy of the following reprints from the Year Book: "Boy's Agricultural Clubs," by D. J. Crosby; "The Use of Illustrative Material in Teaching Agriculture in Rural Schools," by D. J. Crosby; and "County Schools of Agriculture in Wisconsin," by K. C. Davis.

The States of Maine, Michigan, Missouri, Nebraska, North Carolina, New Hampshire, and Texas have issued bulletins dealing with this subject. The following are among the helpful and suggestive ones:

Outlines in Agriculture for Nebraska State Junior Normal Schools, State Department of Public Instruction, Lincoln, Neb.

Nebraska Corn Book, by E. C. Bishop, State Department of Public Instruction, Lincoln, Neb.

A study of corn, potatoes and sugar beets, with an interesting account of the corn contests carried on by school children.

Course of Study and Syllabus for Elementary Schools, New York State, Education Department, Albany.

This contains full outlines of an elementary course in nature study and agriculture.

Syllabus for Secondary Schools, New York State Education Department, Albany.

This contains outline for high school courses in physical geography and in agriculture.

Cornell Nature Study Leaflets, State College of Agriculture, Ithaca, New York.

Course of Study for the Public Free Schools of the State of Texas, State Department of Public Instruction, Austin, Texas.

This contains a brief discussion of agricultural education, and an outline for a course in elementary agriculture.

The following are not free, but are sold at a very moderate price, and are of much value:

The Study of Agriculture, by Eugene Davenport.

The Study of Horticulture, by J. C. Blair.

The Study of Farm Animals, by Eugene Davenport.

The Study of Farm Crops, by A. D. Shamwell.

These four little eight-page monthly bulletins are published by C. M.

Parker, Taylorville, Ill. Price, 25 cents a year each, 1 cent per copy if ordered in quantities of ten or more. These are all edited by noted and able experts, each number dealing clearly and simply with one definite subject, such as Window gardening, Root pruning, The pig and his relatives, Multiplication of plants.

The following will help to a fuller knowledge of the subject:

Practical Agriculture, by C. C. James and John Craig. D. Appleton & Co.. 203 pages; price, 80 cents.

Covers the whole field in simple manner and contains helpful suggestions for the teacher.

New Elementary Agriculture for Rural and Graded Schools, by Chas. E. Bessey and others. The University Publishing Co., Lincoln, Neb.

This little book of 198 pages was prepared by the able teachers of the University of Nebraska in order to provide the teachers of the State with a suitable hand-book of elementary agriculture. The matter is interesting and accurate, but the arrangement, laboratory exercises, and general pedagogical make-up of the book are not so good.

Elements of Agriculture, by J. B. McBryde. B. F. Johnson Pub. Co., Richmond, Va. 270 pp.; price, 75 cents.

A very interesting and simple presentation, with a few good suggestions as to experiments.

First Book of Farming, by C. L. Goodrich. Doubleday, Page & Co. 279 pp.; 64 full-page illustrations; price, $1.

"Especially good on soil and its relation to plant life."—*Course of Study and Syllabus for Elementary Schools,* issued by the New York State Education Department for 1906.

The Soil, by F. H. King. The Macmillan Co., New York. Price, 75 cents.

"Its nature, relations, and fundamental principles of management."—*Course of Study and Syllabus for Elementary Schools,* issued by the New York State Education Department for 1906.

Irrigation and Drainage, by F. H. King. The Macmillan Co. Price, $1.50.

"A most practical presentation of the subject."—*Course of Study and Syllabus for Elementary Schools,* issued by the New York State Education Department for 1906.

Feeding of Animals, by W. H. Jordan. The Macmillan Co. Price, $1.50.

"A most complete presentation of the conditions and problems involved in feeding animals."—*Course of Study and Syllabus for Elementary Schools,* issued by the New York State Education Department for 1906.

Milk and Its Products, by H. H. Wing. The Macmillan Co. Price, $1.

Recommended by the New York State Education Department in the *Course of Study and Syllabus for Elementary Schools* for 1906.

Farm Poultry, by G. C. Watson. The Macmillan Co. Price, $1.25.

"A popular sketch of domestic fowls for the farmer and amateur."—

Course of Study and Syllabus for Elementary Schools, issued by the New York State Education Department for 1906.

Principles of Fruit Growing, by L. H. Bailey. The Macmillan Co. Price, $1.25.

"Very complete presentation of the subject."—*Course of Study and Syllabus for Elementary Schools,* issued by the New York State Education Department for 1906.

Spraying of Plants, by E. G. Lodeman. The Macmillan Co. Price, $1.

"A succinct account of the history, principles and practices of the application of liquid and powders to plants for purposes of destroying insects and fungi."—*Course of Study and Syllabus for Elementary Schools,* issued by the New York State Education Department for 1906.

Commercial Geography, by Gannett, Garrison and Houston. The American Book Co., New York. Price, $1.25.

Recommended by the New York State Education Department in the *Course of Study and Syllabus for Elementary Schools* for 1906.

Commercial Geography, by J. W. Redway. Chas. Scribner's Sons, New York. Price, $1.25.

"Contains commercial value of products, general distribution, exchange and transportation of products."—*Course of Study and Syllabus for Elementary Schools,* issued by the New York State Education Department for 1906.

For an account of the systems of Agricultural Education in foreign lands see the various reports of the U. S. Bureau of Education for the past ten years. In addition to numerous articles in these, one will find the pedagogy of the subject briefly dealt with in the following pamphlets and articles:

Report of the Committee on Industrial Education in Schools for Rural Communities to the National Counsel of Education, July, 1905. For sale by Secretary Irwin Shepard, Winona, Minn. 97 pp. Price, 10 cents.

This covers the field of agricultural education both of elementary and secondary grade. The pamphlet has much good material in it, but is on the whole hardly so valuable as one would expect, coming from so distinguished a committee.

Report of Commissioner L. D. Harvey, of Wisconsin, on *Methods of Procedure in this and other States and countries in giving instruction in the theory and art of Agriculture in Public Schools,* State Department of Education, Madison, Wis.

Our Farmer Youth and the Public Schools, by W. M. Hayes, in the American Monthly Review of Reviews, October, 1903.

This deals with consolidation, teaching agriculture, etc. It has a suggestive and helpful plan for a consolidated school ground, showing location of forest belt, orchard, shrubbery, vegetable and small fruit gardens, flower beds, grass plots, field experiment plots, playgrounds, houses and outhouses.